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THE MATHEMATICS TEACHER

Official Journal of the National Council of Teachers of Mathematics

Devoted to the interests of mathematics in Elementary and Secondary Schools

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THE MATHEMATICS TEACHER

Volume XLIII Number 2

Edited by William David Reeve

Teacher Preparation for a New Era in Mathematics*

By Daniel W. Snader

Professor of Education, University of Illinois, Urbana, Illinois

The Role of Mathematics in the New Era

The recent World War has ushered in what is destined to be a new era in education. The war has brought to a sharp focus the importance of mathematics as an integral part of the education of all youth. Our nation can ill afford to take the chance of reverting to its pre-war indifference to mathematics as a school subject. It is a dangerous matter to live in a scientific and technological age without taking the responsibility of preparing our youth for the realities which are in store for them. Mathematics is an integral part of the culture. Its importance in winning the war can not be denied. Its role in the future developments of our country, in winning and keeping the peace, is equally important.

As mathematics teachers we have a great responsibility—both personally and professionally. We have seen the decline in respect and prestige which mathematics as a secondary school subject suffered during the past two or more decades. We fussed and fumed about the deplorable situations which gave strength and sustenance to decreasing popularity of mathematics in our secondary schools prior to the war. Our alibis in defense of our positions, though justifiable and right, have not stopped the spiral of sabotage. We must admit that the war has been responsible for check-mating the tide of indifference, and outright antipathy toward the study of mathematics in our public schools. Since the cessation of the shooting war we have been given what may be considered a *period of reprieve*—a period during which we should be consolidating our recent gains—and above all making an intense effort at examining critically and without bias the entire mathematics program: If the echoes of our critics are still audible, and I think they are, for we should be our own severest critics, then certainly we should not rest until we have determined the real reasons for the pre-war status of mathematics in this country. It would be easier to resort to name-calling with the "I told you so" finger pointed at our critics. This certainly is *not* the way to consolidate the gains already made nor to bring about the reforms and adjustments which are so necessary. To be conscious of the need for a more enlightened program of mathematics for the secondary schools is the first step toward its achievement.

The role which mathematics is destined to play in the educational program of the post-war era will be determined largely by

* Read at the Annual Meeting of the National Council of Teachers of Mathematics at Baltimore, Md. on April 2, 1949.

the contributions it can and is expected to make

(a) for developing an enlightened citizenry,

(b) for constructive leadership in a democratic society, and

(c) for highly specialized, scientific and vocational pursuits.

There are vastly divergent opinions as to the nature of the mathematics and the most appropriate means for developing the mathematical competencies essential for a rich and full life in a democracy. There are those who advocate that mathematics in the elementary school be taught incidentally in connection with an "activity" program. The idea of drawing on mathematics to give meaning and body to an "activity" program is highly desirable. The danger in this approach lies in the fact that *mathematics, by its very nature, requires sequential learning*. It is a system of concepts and ideas—and must of necessity be taught and developed in a systematic way.

If we wish to reap a rich harvest of applies, we can not afford to neglect the trees. To carry this analogy a bit further, it seems apparent that the old apple tree (mathematics) has gained a vast host of admirers as a result of the war. What these admirers (whether ardent or lukewarm) are concerned about is the problem of *pruning* the tree expertly so as to preserve its life of usefulness and to make its fruit more palatable and functional for generations to come.

To discuss adequately the purposes, and techniques of the "pruning" process would require more time than is allotted to me on this program. Consequently, I shall limit my discussion to those aspects of the problem which have a direct bearing on professional preparation of mathematics teachers for this post-war era.

Some Recommendations from the Commission on Post-War Plans[1]

This commission has presented an excellent report of its proposed plans for secondary school mathematics' programs in Post-War America. May I suggest that every teacher of mathematics and curriculum designer study this report very carefully. It presents a very fair analysis of the mathematics' situation in this country and makes a series of significant proposals for up-grading mathematics in the immediate future. Among the proposals we find such guiding principles as these:

1. "*The school should insure mathematical literacy to all who can possibly achieve it.*" Mathematical literacy in this technological age ranks in importance with the mother tongue as a means of intelligent communication.
2. "*We should differentiate* (our courses in mathematics) *on the basis of needs, without stigmatizing any group, and we should provide new and better courses for a high fraction of the schools' population whose mathematical needs are not well met in the traditional courses.*" When this is done we will find many more high school pupils happily studying mathematics of a suitable type—and without a feeling of inferiority. On the other hand, the potential leaders can be given a much richer preparation for scientific and technological pursuits than is generally provided at the present time. The real challenge we mathematics teachers are facing is the perennial problem of adapting the subject matter and techniques of instruction to the needs (present and future) and abilities of the individual boy or girl.
3. "*We need a completely new approach to the problem of the so-called slow learning student.*" This is a problem as broad as the general field of "guidance." It is as involved as the human mechanism itself. The materials of instruction must be drawn from the small and limited universe in which the pupil lives. The teacher must be a salesman of mathematics, a pastmaster in the art of demonstrating the usefulness of the basic concepts of mathematics. He must be able to develop, through the laboratory techniques of teaching, meanings and general principles of operation before drill in the manipulative skills can become purposeful and effective. Society can ill afford to neglect this challenge. The maladjusted and unadjusted children of today will, in the years ahead, remember their unpleasant experiences and frustrations and will not

[1] See "The First Report of the Commission on Post-War Plans," MATHEMATICS TEACHER Vol. XXXVII, May 1944, No. 5.

hold that society which allowed it to happen guiltless of its neglect.

4. *"The sequential courses should be greatly improved."* This scientific, technological and mechanized world is demanding a type of training for skilled workers and researchers which involves more mathematics, and of greater breadth and depth, than we have heretofore included in our usual four-year sequence. The guiding principles presented several decades ago by the National Committee on Mathematical Requirements have been quite generally accepted as the basis for organization of the sequential courses, often referred to as the College Entrance courses. These courses now need to be revitalized and perhaps "pruned" to allow for the growth and development required to meet the demands of the present age. This pruning must be done carefully. New and more challenging courses must be developed for our potential Einsteins of tomorrow. To neglect this segment of our youth (however small it is) during our attempts to adjust to the needs and abilities of the mediocre and dull pupils would be flirting with national decay, if not actual destruction. Our tasks are enormous and indeed challenging. The nation is looking to this organization (The National Council of Teachers of Mathematics) for guidance and direction in promoting truly functional, continuous, and cohesive programs in mathematics from the elementary schools and on through the community colleges. The real impact of the excellent reports submitted by the Joint Commission on the *"Place of Mathematics in the Secondary Schools"* and the Progressive Education Association's report on *"Mathematics in General Education,"* the National Committee's Report on Post-War Plans, and others are hard to measure. One observable influence these reports are having is reflected in the local and state curriculum studies now under way in many parts of the country. These reports are really invaluable, not as blueprints, but as guides for constructive studies. They should be among the prized possessions of every teacher of mathematics, general educators, and curriculum workers in this country. The distribution of all publications of the National Council should be more comprehensive. The better schools throughout the land will always be on the "inside" of things and will benefit by these contacts and direct experiences with committee work. But what about the many small schools (there must be thousands of them throughout our land) who are not kept informed concerning the trends in curriculum reorganization, recent discoveries in the field of learning, improved methodology and classroom procedures? This is a *state* or perhaps a *national* problem . . . and should be attacked on a statewide or national basis. To have found so many young men who were unfit for military responsibility and service because of *illiteracy* surely reflects upon certain local communities and states . . . but it becomes a national problem when the participation in the defense and protection of our nation as a whole is at stake. If federal funds are ever made available to the various states for the purpose of equalizing educational opportunities, . . . then certainly such potentially cancerous conditions could and, I believe, would be removed. Meanwhile let me repeat a suggestion I made at the Indianapolis convention: The National Council would do well to consider the feasibility of sponsoring a permanent National Committee for the Advancement of Elementary and Secondary School Mathematics. The committee should consist of at least one member from the present Cooperative Committee on Science and Mathematics Teaching, representatives from business and industry, public school administrators and class room teachers of mathematics for the purpose of carrying on and extending the activities which the Joint Commission has begun. There is a crying need for increasing the scope and continuity of the interactive study of the total program, including *teacher preparation*, in order to meet the demands of rapidly changing school conditions.

This brings me to a consideration of another vitally important aspect of the problem.

The Professional Preparation of Secondary School Teachers of Mathematics

We shall have to by-pass at this time the problem of teacher recruitment, and the challenge of teacher selection and consider what might be called the *"musts"* in teacher preparation for the new era in mathematics.

The training program for teachers of junior and senior high school mathematics is due for careful scrutiny and reform. All that has been said about the proposed changes in curricula for maximizing the contributions which secondary school mathematics can and should make in the development of the future scientists and highly skilled technologists will avail us nothing—if we neglect to prepare our

coming generations of teachers for the professional tasks they will be expected to perform.

Recently I took the time to examine published catalogues of courses offered at leading teachers colleges and universities throughout the country. I attempted to determine whether these institutions have made any significant changes in their professional programs for teachers of secondary school mathematics during the past few decades. The conditions are no better than most of us have surmised. Very few teachers colleges or university Schools of Education, are at present offering prospective teachers of mathematics the kind of preparation required to make teaching in the field truly a profession.

Professor C. O. Oakley[2] of Haverford College, asserts that even on the graduate level we do a very poor job of preparing *teachers* of mathematics. He states what many of us have observed to be true, e.g. "Most departments of mathematics design their courses for the master's degree primarily to train material suitable for the doctorate work and the work of the doctor's degree to train people in the ways of research." He observes further that "advanced work in education is inadequate for training of teachers of mathematics"; and that "most advanced work in mathematics trains research people, *not* teachers."

This whole problem of teacher training in mathematics requires immediate attention. Real improvement in the secondary schools will never be achieved through revisions of the various curricula alone. Teachers must be adequately prepared for their new responsibilities.

Suggestions for Improving the Preparation of Secondary School Teachers of Mathematics

1. *We must build a really dynamic curriculum for teachers of mathematics within a professional matrix.*

Since neither pure mathematics courses nor general courses in education prepare teachers adequately for the secondary schools, it is imperative that we develop a special curriculum for prospective teachers of secondary school mathematics which will provide those experiences, both in theory and practice which are essential for up-grading the level of instruction. Wholehearted professional cooperation in this matter will be required. The training of teachers of mathematics for the secondary schools must be viewed as a task quite distinct from the preparation of research mathematicians or general educationists. The new program for teacher training in mathematics must develop within a truly professional matrix. The basic professional experiences essential to all secondary school teachers of mathematics can be determined, at least partially, through *job analyses* of the tasks teachers are expected to perform both in and out of the classroom. This approach has great possibilities. Why has it not been used to a greater extent? The pressures exerted both by the mathematicians and general educationists upon the teacher training program are quite evident. The time has come for us to build a dynamic teacher training program based upon the findings of researches yet to be undertaken.

The President's Commission of Higher Education[3] admonishes us,

> *". . . the responsibility of making sure that the kind of education given these persons who are to teach the young will fit them to do the job as it should be done. They must be imbued with the spirit and methods of free inquiry and skilled in the art of communicating these to others."*

This report[4] also emphasizes the need for further cooperation

> *". . . specialists in education and those in liberal arts must replace their mutual skepticism with a cooperative relationship based on recognition of the fact that teachers need to know both what they are teaching and how to teach it."*

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[2] Oakley, C. O. "The Coming Revolution—in Mathematics," Mathematics Teacher, Vol. XXXV, Nov. 1942, p. 309.

[3] "Higher Education for American Democracy," Vol. 1, Report of the President's Commission on Higher Education, p. 77.

[4] *Ibid.*, p. 77.

2. *Have an adequate "follow up" system to determine how well our training program prepares young teachers of mathematics for public school assignments and for professional leadership.*

The results of this in-service check up could well be used as a basis for departmental improvement programs.

3. *Provide a "clearing-house" or "service bureau" on the college or universtiy campus to which our graduate teachers can apply for aid and guidance in solving their professional problems as they occur.*

When the problems arising in the field are thus brought to our attention and are judiciously referred to and discussed in our professional courses, increased meaning and interest in the training program will be developed. These problems can be used as a basis for very worth-while in-service training programs, workshops, and the like—and also for further evaluation, professional revision and improvement of the professional courses.

4. *To correlate mathematics with related fields such as physical science, engineering, aviation, economics, manual arts, statistics, etc., requires that teachers be prepared through survey courses, directed professional reading and independent study to do the job.*

To teach mathematics effectively requires such versatility. Teachers themselves have frequently requested special courses designed for correlating mathematics with other subjects. They have asked for courses designed to provide them training in a mathematical laboratory, where they could learn the mathematics employed in the construction of simple instruments and models, learn how to use them to enrich their regular classroom teaching by relating mathematical theory with practical applications, and learn to use their hands in building many of the simple aids to instruction. Isn't it about time that the teacher preparing institutions welcome these sincere requests from teachers now in service, or better still solicit their advice in designing the professional curriculum for the new era? That famous automobile slogan, "Ask the man who owns one" can be applied with meaning and challenge to the construction of this new curriculum for teacher training. If we want to find out how our present program consisting mainly of pure mathematics and general educational theory fits our students for teaching secondary school mathematics in this day and age, why not ask those teachers of experience who were exposed to that sort of program. We need to check our training program continuously and be guided in our revisions at least partially by the reports coming from our *professional proving ground,* the classrooms of the American schools.

5. *Increase the period of pre-service preparation of teachers in mathematics to five years.*

Neither mathematicians nor educationists object to this proposal. However, it frequently happens that their ideas concerning the nature of the fifth year's program vary considerably. The fifth year should not be devoted entirely to the study of higher mathematics, nor to educational theory courses. If the purposes for extending the pre-service training period to five years instead of four are to provide those experiences which have not (and perhaps cannot) be included in the four year program, then we should be extremely careful in planning for the fifth year lest we fail to reach our professional objectives. As mathematicians and educators we must see this task of preparing teachers of mathematics for the secondary schools as one requiring the highest type of cooperation. We must be thoroughly aware of the fact that our task is not to prepare research mathematicians, however worth while this training would be, but to develop dynamic teachers of secondary school mathematics, teachers who reflect well-balanced and integrated per-

sonalities, who are interested in the professional job of stimulating and properly guiding human growth and development through the medium of teaching mathematics in the secondary schools. The program required to prepare young men and women, prospective teachers of mathematics, for the tasks which lie before them certainly is quite different from that designed for the training of research mathematicians. This will not be refuted by any one who has had ample experience in both these areas. The fact is that we have made a mockery of our training program for teachers of mathematics because we have not given this problem the attention it deserves. Too often some of our best prospective candidates have been either directly or indirectly influenced against the preparation for teaching in secondary schools by the devastating inference that if one chooses to prepare for teaching in secondary schools, it is a sign of personal inferiority or inability to comprehend mathematics on a higher level. This, of course, is far from the truth and one of the reasons why we do not have more students of top notch ability in mathematics and allied sciences enrolled in our Teachers Colleges. We shall never be able to correct our deficiencies in this area until candidates of real ability in mathematics, who have the prerequisite personality traits, are urged to prepare for leadership in this field. The report of the President's Commission on Higher Education brings this out very emphatically. The fifth year of pre-service training should be planned in accordance with the professional needs as might be determined by the critical researches referred to previously. You and I might wish to argue the case for more mathematics, more education courses, a period of off-campus internship, etc., to be included in the fifth year program. It would seem advisable, however, first to *find out through careful "job analyses" in what areas our training program is weak and then center our curriculum discussions on ways and means of improving the total professional program.*

6. *Improve the Training Facilities.*

(a) The training school facilities are perhaps the most neglected phase of the entire educational sequence. Up-to-date instructional equipment and supplies are rare in most of our training schools. Is it any wonder that young teachers of secondary school mathematics are charged with teaching the subject in "cook-book" fashion? If cadet teachers are expected to use instruments, visual aids, instructional models and other devices to vitalize their efforts where are they expected to learn the laboratory techniques for doing this sort of work if little or no attention is given to the development of these techniques during the period of their professional training. Shall we continue to *talk about teaching methods* but neglect to provide the equipment and teaching facilities for demonstrating their real worth under actual classroom conditions? We must increase the facilities of the training school so that through observations, gradual participation and finally full teaching responsibility the experiences which develop skillful teaching are made comparable to those which hospitals provide for the training of young medicos.

(b) A cadet's teaching experiences should be so designed as to provide for wide and varied opportunities for adapting instruction to the individual interest, needs, and abilities of the pupils entrusted to his care. Our present teacher training programs have given little more than lip-service to this fundamental type of professional experience. Where shall these techniques be learned? The teacher of "methods" is already given the absurd task of trying to present in one or perhaps two three-hour courses, techniques appropriate for teaching the varied subject matter of grades 7, 8, and 9, as well as that of high school algebra, geometry, and trigonometry. To enlarge the scope of "methods" without increasing the time and credit allotment

is a sign of professional myopia. What makes the situation even worse is the fact that under our present curricula for teachers of mathematics, consisting mainly of courses in collegiate mathematics and educational theory, cadet teachers quite frequently know less about the subject matter of the secondary schools (the subject matter they are supposedly preparing to teach) than they knew before they entered college. Many cadet teachers of mathematics receive no further preparation in the areas of arithmetic, general mathematics of grades 7 and 8, and (or) demonstrative geometry than that to which they were exposed as students in our elementary and secondary schools.

When we are willing to face these facts we really behold a very pitiful situation. When I make the plea for remedying this situation I am in no way attacking the place of collegiate mathematics in the curriculum nor of the place of truly functional educational theory courses. The primary purpose is to create an atmosphere in which mutual trust and cooperation abound—an atmosphere in which neither mathematics nor education is on the defensive—but where representatives from both areas can meet calmly, and without professional bias, develop a modern curriculum for teachers of secondary school mathematics. *For this purpose the mathematics and education departments should have as their representatives persons who have real interest in this problem and who are by training and experience qualified for this important work.*

7. *Define the purposes of the training school.*

The educational functions of the training school need clarification. Is its chief purpose that of "experimentation"? Is it the center at which new methods of instruction, new curricula, new techniques for testing and evaluating teaching and learning, new procedures for guiding human growth and development, etc., are created, checked experimentally, and if found to be worth while, are made available for use in the public schools? Or shall its main function be to provide a suitable place on the college campus where student teachers are gradually inducted into challenging problems and responsibilities of the teaching profession? Should the emphasis be on the proper *use* of techniques, curricula, theories of learning, guidance and evaluation already known rather than on the *development* of new theories and practices? Or should there be a two-fold purpose, e.g., to provide for observation of, and direct experiences in, the most commonly accepted techniques and educational practices; and secondly, to provide cadet teachers with opportunities for direct participation in programs of instructional and curricular research and experimentation? The former type of preparation would tend to preserve the "status quo" in educational patterns, while the latter would tend to prepare young teachers for creative, frontier work. We speak glibly about objectives such as these, but does our present training program, including practice teaching, really develop the desired competencies.

8. *Close the gap between the Department of Education and the Training School.*

The members of the training school staff should be considered bona fide members of the College of Education and referred to as such. They should be selected with great care on the basis of personality, teaching ability, mathematical scholarship, professional preparation, personal interest, and enthusiasm for the work of preparing teachers, and in accordance with the special functions they are to perform. Their duties and responsibilities are perhaps the most important of the entire educational sequence. Their professional status should be enhanced by placing them on the same salary scale and subject to the same regulations for promotion and professional advancement as their colleagues who teach educational theory courses. In order to bridge the gulf usually

existing between the Education Department and the Training School and to correlate more closely educational theory and practice all members of the Education Department should be capable of demonstrating the applicability and practicability of the theories they endorse through use of the training school facilities. The Professor of Surgery makes his lectures on the intricacies of surgical skills and techniques practical and meaningful by following his lectures with actual, realistic demonstrations in the operating room of the hospital (which is the medical training school).

9. *Possibilities for staff improvements.*

It is quite likely that when the results of significant researches in the area of teacher preparation in mathematics become available, new types of education for supervisors, and critic teachers of mathematics will be in demand.

The time is coming when a truly professional program for teachers of secondary school mathematics will evolve. As the Joint Commission of the Mathematical Association of America and the National Council of Teachers of Mathematics has stated in its excellent report on the "Place of Mathematics in Secondary Schools."[5]

"Although the traditional 'major work' of the university or college department of mathematics has been for the most part quite well conceived so far as content is concerned, *its actual bearing on secondary education has too often been left for the student to infer.* Moreover, university and college teachers have not always kept in touch with the problems of secondary education, even when a large number of their more advanced students were preparing for high school positions. EVERY MATHEMATICS DEPARTMENT OF ANY SIZE SHOULD HAVE SOME MEMBER, WELL TRAINED IN MATHEMATICS, WHOSE DOMINANT CONCERN IS THE TEACHING OF MATHEMATICS IN THE HIGH SCHOOL. *In addition to an awareness of the difficulties of the problems of secondary education, such a person should reveal a strong devotion to the subject that he teaches. Though he may not be engaged in technical research, there are plenty of ways in which he can show an extensive knowledge, activity, and enterprise.*"

The Joint Commission also questions the suitability of the graduate work in mathematics for those who are preparing to teach in high schools. Surely from the broad field of mathematics we should be able to build courses of real value to high school teachers. If the Mathematics Department of our colleges and universities keep in mind that their main function in the training of secondary school teachers is one of *service*, and that to be of most service, mathematics content courses must be geared to meet the needs of the profession, their position in the training of teachers will be greatly enhanced—and at not one iota of loss, but possibly an appreciable gain, to the traditional program for developing research mathematicians.

The need for providing adequate teacher preparation for the new era in mathematics is critical. If we neglect this professional phase of the program, our efforts in connection with modernizing the secondary school curriculum will be ineffective. Now is the time for cooperative and concerted action on the entire, broad professional front.

In summarizing, let us keep these points in mind:

1. Now is the time to consolidate the important gains for secondary school mathematics which the late war has brought about and simultaneously seek to improve the entire mathematics program.

2. The role of mathematics in the postwar educational program will be determined on the basis of the contributions it can make to the development of enlightened citizenship, constructive leadership, and highly specialized training for scientific and vocational pursuits.

3. The recommendations of the "Commission on Post-War Plans" are excellent guiding principles for developing and promoting a truly functional and continuous

[5] Joint Commission of the Mathematical Association of America and the National Council of Teachers of Mathematics, "Place of Mathematics in Secondary Schools," Bureau of Publications, Columbia University, 1940, p. 199. The italics and capitals in this quotation are by the author of this paper, Professor Snader.

program in mathematics ranging from the elementary schools and on through the community colleges.

4. The pre-war indifference to the mathematics of the secondary school bordered on national sabotage. In this age of technology mathematical literacy should be mandatory for all American youth who are capable of achieving it.

5. Secondary school curricula now in the making can not succeed unless teachers are prepared for their new responsibilities. This calls for much needed improvements in the curricula for teacher training.

6. Adequate training for teachers of secondary school mathematics requires more than traditional collegiate mathematics and educational theory. The program, to be effective, must develop within a professional matrix. The leadership for doing this job must come from *mathematics-education hybrids* who can represent both subject matter areas without bias and in a professional manner.

7. The new curriculum for teachers of secondary school mathematics should be based upon "professional job analyses" and other researches.

8. The training school facilities must be improved so as to raise the status of teaching from the level of an occupation to that of a profession.

9. The versatility of all persons engaged in the training of teachers must be increased. The ultimate purpose of the program is not simply to teach teachers how to teach, theoretically, but to correlate theory and practice by actual demonstrations in the training school.

On the Status of Teaching Load, Salary, and Professional Preparation of Junior College Mathematics Teachers*

By H. G. Ayre
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When the problem of teacher preparation is considered, several questions arise immediately. Some of them are:

What educational objectives is the teacher trying to achieve? How do these objectives agree with the philosophy of the school system in which he works? How well is the teacher educated to do the job he is actually doing? How well is the teacher's education fitted to the proclaimed objectives of the system? Is the teaching load adjusted so that efficiency may be expected? Is the teacher's salary adequate?

The answers to these and other pertinent questions are rather elusive; however, it seems important to bring into relief certain factors bearing upon these questions as they apply to junior college mathematics. The following discussion is primarily a report on a questionnaire study of existing conditions as regards teacher preparation in mathematics, teaching load, and salaries in public junior colleges in eight central states.

To see the problem in proper perspective, it may help to review the growth and objectives of the junior college.

The first junior college of the nation was established at Joliet, Illinois, in 1902. The organization of this first junior college was, no doubt, highly influenced by the philosophy of President Harper of the University of Chicago, who has been called the father of the junior college. For two decades or more the junior college was chiefly fostered by privately controlled institutions. There was a marked increase in the numbers of junior colleges established during the five year period 1925–1929. The public controlled colleges accounted for 57% of the increase. During the twenty-one year period from 1928–1948, the number of junior colleges increased from 408 to 663, 62.5%, while the enrollment jumped from 50,529 to 455,048 an increase of 800%.[1] The war years witnessed a severe setback in junior college growth, but in spite of this handicap, there has been a 20% increase in the number of junior colleges and 233% increase in enrollment during the past decade. The 1948 enrollment was 54.5% over that of 1947. At the present time 49% of the junior colleges with at least 75% of the enrollment are publicly controlled colleges.

There are many factors which lead to the conclusion that the junior college is a rapidly developing institution that has already become an integral part of the American system of education. Some of these factors are (1) the statistical facts as to the number of junior colleges, their enrollments, and rate of increase, (2) the national and regional organizations for the study and improvement of education at the junior college level, (3) surveys and studies by such groups as the President's Commission that made this important statement, "The thirteenth and fourteenth years of our educational system are about as widely needed today as the four-year high school was a decade ago. The Commission recommends that all states which have not already done so enact permissive legislation under which communities will be authorized to extend their public school system through the fourteenth year."[2]

The early aims and objectives of the

* Presented to the Junior College Section of the National Council of Teachers of Mathematics at the annual meeting in Baltimore, Md., April 2, 1949.

[1] *Junior College Directory*, 1948.

[2] Vol. III of the "Report of the President's Commission on Higher Education."

junior college were pretty well formulated according to President Harper's argument that weak four-year colleges would do well to give up their inadequate efforts toward senior college education and concentrate on the freshman and sophomore years leaving the junior and senior years to the universities and professional schools. This idea struck a responsive note with many small colleges having difficulty in maintaining the standards of scholarship required of degree-granting institutions, and also probably beset with financial difficulties in furnishing efficient instruction through the junior and senior years. Of course, many other factors influenced the development of the junior college. Time does not permit a detailed discussion. Suffice it to remark that one of the chief aims of the early junior college was to make more accessible to the local community the lower division of college and university training. Just recently this purpose has served, and is still serving the universities in the so-called university extension centers. The college preparatory function of the junior college has been so strong that it was not uncommon for administrators to boast of the fact that four-fifths of their students expected to go to college.

In spite of the college preparatory emphasis, it was soon found, according to prevailing estimates, that only 20 to 25% of junior college students were actually going on to college. Two new functions were rapidly developing; namely, general education and vocational education. During the past decade, the enrollment in special vocational courses has been striking, to say the least. No doubt, the war has had a strong influence on this trend. In 1945, about 65% of junior college students were enrolled in special courses. Considerable leveling off has been experienced since the war, but 39% were still in special courses in 1948.

The swing to terminal courses has received a tremendous impetus in recent years. For example, the state of Illinois has a strong movement for the establishment of a system of junior colleges. The Commission on Higher Education of the state specifically recommends a terminal program rather than a preparatory program. Perhaps the most spectacular move has been in the state of California where there seems to be rapidly emerging the "New American College"[3] covering grades eleven to fourteen inclusive. This new college has set for itself the attainment of five major objectives: (1) an adequate foundation in general education, (2) orientation in major areas of human needs, (3) comprehensive orientation in major fields of learning, (4) furnishing basic learnings for specialization and, (5) vocational preparation.

It is clearly recognized that the junior college is a part of secondary education. There is no doubt in the mind of the writer that the primary function of the junior college is terminal education and that the college preparatory function is rapidly becoming a minor function.

Koos states that "the junior college must flourish and take its place as a prominent feature of a prevailing pattern of school organization. · · · it can no longer remain what too many persons still think 'just another place to get the first two years of college or university work.' "[4]

A study of the literature clearly shows that students of junior college education are agreed on at least three major aims of the public junior college program. First, the program aims to provide general education for all students; this may be terminal education for many. Second, to provide vocational or semi-professional education for those who expect to enter industry or business at the close of the junior college years. Third, to provide preparatory training for those who expect to continue academic study in the senior college.

It cannot be denied that terminal edu-

[3] Sexson and Harbeson, *The New American College*. New York: Harper and Brothers.

[4] Leonard Koos, "Points of Needed Curriculum Development." *Junior College Journal*, XVI (May, 1946), pp. 401–410.

cation is making inroads in certain areas of the junior college curriculum. Reynolds found that of 594 terminal course, 47.8% were for general education and 52.2% were for vocational education.[5] However, none reported terminal courses in mathematics.

We have briefly reviewed the growth and purposes of the junior college. As teachers of mathematics, we are interested in knowing what is going on in our field of interest. What are we doing to meet these growing demands in the junior college? How well are our teachers prepared for the job? What courses are being taught in mathematics? How heavily are the mathematics teachers loaded and how about their compensation?

The writer attempted to secure some information on these points by sending a questionnaire to 77 public junior colleges and 15 university extension centers in eight of the central states.[6] It was thought that the situation in the junior colleges might differ from that in the university extension centers. However, the replies on one hundred questionnaires revealed no significant difference between the two institutions as regards the questions under consideration.

We are all familiar with the arguments about the master teacher with a minimum of academic training and the hypnotizing personality versus the highly specialized Ph.D. Be that as it may, it remains a fact that degrees and academic preparation are still used to accredit colleges and rate teaching personnel.

Table I shows the per cent of one hundred public junior college mathematics teachers from eight central states who held the bachelor's, the master's, and the doctor's degrees in the fall of 1948, and the per cent of majors and minors in certain subjects.

It is observed that all teachers returning the questionnaire held the bachelor's degree, 91% had earned the master's degree and 3% had attained the doctorate. Mathematics was the major subject for 70% of the undergraduate degrees, 55% of the master's degrees, and 100% of the doctorates. It is also shown that 24% of the mathematics teachers did major graduate study in the field of education and only 5% in mathematics education.

The picture of the academic preparation of these teachers is made a little more revealing by a study of Table II which gives an analysis of semester hours of study in mathematics, related areas, and mathematics education.

In consideration of the number of junior college mathematics teachers with majors in subjects other than mathematics and the fact that 36% of those who hold the

[5] James Reynolds, "Certain Junior College Curriculum Problems." The Junior College Journal, XV (December, 1947), pp. 134–138.

[6] The study is limited in scope and should not be interpreted to represent final conclusions.

TABLE I

Per Cent of Degrees, Majors and Minors, in Certain Subjects as Reported by One Hundred Teachers of Junior College Mathematics in Eight Central States

Degree	Per Cent	Per Cent in				
		Mathematics	Education	Mathematics Education	Science	Others
Bachelor	100					
Major		70	10	0	6	14
Minor		14	13	0	45	28
Masters	91					
Major		55	24	5	9	7
Minor (No Minor, 25 per cent)		22	28	0	17	8
Doctors	3					
Major		100				

Table II

Semester Hours in Mathematics, Related Areas, and Mathematics Education

	Range (hrs.)	Mdn. (hrs.)	Mean (hrs.)	Q_1 (hrs.)	Zero (hrs.)
Mathematics:					
Undergraduate	0–64	28.6	27.2	24.0	—
Graduate	0–121	19.7	21.0	10.0	36%
Related Areas:					
U. Grad. and Grad.	0–152	5.7	14.0	—	44%
Math. Edu.					
U. Grad. and Grad.	0–34	5.6	6.3	—	14%

master's degree have had no graduate study in mathematics, it surely cannot be said that, on the average, there has been too much preparation in straight mathematics. Furthermore the median preparation for those without graduate degrees is 28.6 hours of undergraduate mathematics and 19.7 hours of graduate mathematics for those holding graduate degrees. Forty-four per cent of the teachers had no work in related areas and 14% had no work in mathematics education.

An unbiased judge might be expected to rule very unfavorably upon the practice of teaching junior college mathematics with less than 24 hours of study in college mathematics to say nothing of the 36% with no graduate study in mathematics. To the teacher who thoroughly enjoys mathematics, 121 hours of graduate study in mathematics does not seem excessive, but can such a "luxury" be justified in light of the neglect in preparation in related areas and the art of teaching the subject? No doubt the answer depends upon the goals to be attained. But let it be recalled that the goals are those of the junior college—a part of secondary education. It would seem that the preparation of these one-hundred teachers represents too many extremes. In the case *of those with less than 24 hours of study in college mathematics*, it is more likely than not that much time has been devoted to educational theory and not to related areas or mathematics education.

Table III summarizes the opinion of teachers as to the value of their academic training for junior college teaching. The table shows the per cent of replies for each rating (poor, satisfactory, and excellent) on both the undergraduate and graduate level for each area listed in the left-hand column. There is also a column showing the per cent of teachers failing to indicate a rating on each of the two levels. There seems to be no rating with sufficient agreement to justify a general conclusion. There is, in general, a wide variation in opinion with some agreement that courses in straight mathematics are generally rated from satisfactory to excellent, while courses in education and psychology tend to be rated as poor to satisfactory.

Quite often the educand can give helpful suggestions on the improvement of his preparation. Table IV shows the reaction as to whether more courses in the four

Table III

Teacher Evaluation of Academic Preparation for Junior College Teaching

Area	Poor	Satisfactory	Excellent	No Reply	Poor	Satisfactory	Excellent	No Reply
Mathematics Education	15%	44%	18%	23%	6%	26%	21%	47%
Straight Mathematics	2	21	64	17	1	28	44	27
Courses in Related Areas	10	30	32	28	3	29	19	49
Gen. Edu. Theory	20	54	11	15	14	30	15	41
Psychology	18	50	19	13	7	22	17	54

areas listed in the left-hand column would have improved the teacher's preparation for junior college training.

TABLE IV

How Could Your Preparation for Junior College Teaching Have Been Improved?

More Courses in	Per Cent Yes	Per Cent No	Per Cent No Reply
Mathematics	40	6	54
Related Areas	60	5	35
Education	8	18	74
Mathematics Education	27	16	57

In only one case did a majority of teachers indicate an opinion on this item. The results are easily summarized by noting that forty out of forty-six replies favored more mathematics, sixty out of sixty-five would like to have more courses in related areas, twenty-seven out of forty-two favored more courses in mathematics education, and only eight out of twenty-six teachers thought more courses in education would be helpful.

From the written comments there seemed to be a desire for more emphasis on the application of mathematics to engineering, vocations, etc. Some would like better and more inspiring teachers in the teacher education universities and colleges.

TABLE V

Teaching Experience

Level	Per Cent of Teachers	Range in Years	Median Years	Mean Years
Elementary	32	1–15	3.5	4.0
High School	91	1–32	8.4	10.8
Jr. College	100	1–30	4.2	6.1
Sr. Col. and U.	34	1–14	2.9	3.3
Total	—	1–42	15.2	16.5

Table V summarizes the situation as regards teaching experience. It is seen that 91% have had high school teaching experience, 32% have had elementary school experience, and 34% have taught in senior college. The range of experience extends from 1 to 42 years with a median experience of 15.2 years. It would seem that the junior college mathematics teachers are chiefly recruited from the high school faculties. If this is the case, the situation regarding teacher education as suggested in Tables I and II is all the more perplexing.

The returns on the status of teaching load shows that the number of teaching periods per week ranges from 4 to 33 with a median of 17.2 periods and a mean of 17.0 periods. While 33 classes per week is surely an excessive load, this seems to be an extreme case for only 19% had more than 20 classes per week.

The size of classes ranged from 2 to 42 with 20 as the average number in a class. Therefore, it seems that the teaching load as regards the size and number of classes is not excessive.

Twenty-three per cent of the teachers reported they taught from 1 to 6 junior college classes in other departments and 33% taught from 1 to 5 high school classes.

The situation as to salaries has some very bright spots and many discouraging aspects. The range was from \$2325 to \$5645, the median \$3600, and the mean \$3500. Of a group of teachers in which 91% have attained the master's degree, it seems unfortunate that any teacher should be asked to teach nine months for less than \$3600, but the tragic fact in this case places 50% of the salaries below this figure.

Another index of the aims which a college is trying to achieve is given by the types of courses being taught.

Table VI shows the mathematics courses being offered and the per cent of teachers teaching each course during the fall semester, 1948.

The data in Table VI clearly show that college preparatory mathematics "occupies the driver's seat." There is considerable favor shown toward the unified course in college algebra, trigonometry, and analytic geometry. It is possible for this course to be terminal for students preparing for careers in business or industry. There are a number of lower level courses such as intermediate algebra, fundamentals of mathematics, review

mathematics, etc., which may be given for general education, but only two cases were reported where courses were definitely designed as terminal courses in general education.

If the information in this study is summarized, it seems clear that (1) the education of these one hundred teachers was definitely aimed toward the goal of teaching college preparatory subjects, (2) the suggestions for improving the teacher's preparation tend toward the pre-professional and college preparatory aims, (3) of the courses being taught the college preparatory courses are unquestionably in the majority, (4) the fact that only 19% had more than 20 class periods per week with an average of 20 students per class indicates a fair teaching load, (5) there is much to be desired in order to raise salaries to a respectable level; however, the salaries of these 100 junior college teachers compare favorably with those of assistant professors in senior colleges and universities, where, in general, the required academic preparation is greater. In a study made by the American Association of Colleges for Teacher Education, it was found that, in 186 institutions located in the 48 states and the District of Columbia, the median salary for assistant professors was $3600 with a range from $2100 to $6000.

TABLE VI

Mathematics Courses Being Taught by One Hundred Junior College Teachers in Eight Central States, Fall 1948

Courses	Per Cent Teaching the Courses
College Algebra	57
Calculus	56
Combination Course—Col. Alg., Trig. Anal. Geom.	46
Trigonometry	31
Analytic Geometry	21
Intermediate Algebra	13
Business Mathematics	6
Fundamentals of Mathematics	5
Solid Geometry	4
Slide Rule	4
Review Mathematics	2
Terminal Mathematics for General Education	2
Statistics	1
Different Equations	1

What an individual *does* is quite often a better index of his goals than the lip service he may render. In a similar manner, teacher preparation and curricular offerings may be a better index of the actual goals being attempted in junior college education than the statements of the goals as set forth by educators and specialists in junior college education.

A comprehensive survey of the studies on junior college mathematics is impractical at this time. However, it seems apropos to cite a few instances.

Koos[7] found that of the mathematics teachers in forty-eight junior colleges, 34.9% had a double minor in mathematics, 23.3% had graduate or undergraduate major or combination major and minor in mathematics, 24.1% had a double or single minor in mathematics, while 16.0 were without majors or minors in mathematics. Garrison[8] states that the "junior college is not a research but a teaching institution," and points out that "graduate schools should make provisions to insure professional competence as well as subject-matter mastery." Among the shortcomings in the preparation of instructors, Pugh lists the following:[9] "(1) preparation too frequently of a narrow and specialized nature, (2) have content point of view rather than student point of view, (3) lack of suitable balance of subject-matter and professional training, (4) do not understand the junior college, (5) lack ability or knowledge to relate their teaching to practical everyday problems. · · ·"

In his most excellent study of mathematical objectives in the junior college, Kidd[10] found that in 154 public junior

[7] Leonard A. Koos, "Junior College Teachers: Subjects Taught and Specialized Preparation." *Junior College Journal,* XVIII (December 1947), 196.

[8] Lloyd A. Garrison, "Preparation of Junior College Instructors." *Junior College Journal,* XII (December 1941), 204–209.

[9] David B. Pugh "Shortcomings in Preparation of Instructors." *Junior College Journal,* XIV (May, 1944), 405–415.

[10] Kenneth P. Kidd. *Objectives of Mathematical Training in the Public Junior College.* Doctor's Dissertation, Nashville, Tenn., George Peabody College for Teachers, 1948.

colleges, trigonometry, college algebra, analytic geometry, differential and integral calculus were offered in more than 75% of the institutions while only 23% of the same institutions provided courses in mathematics especially designed for general education.

A recent survey of 34 junior colleges in the Southern Association of Junior Colleges shows the number of semester hours being offered in mathematics and the titles of the mathematics courses.[11] The 34 colleges offer a total of 1016 semester hours in mathematics distributed over 65 different courses. An inspection of the data shows that college algebra, trigonometry, analytic geometry, and the calculus account for 47.3% of the total semester hours; solid geometry and descriptive geometry account for 7.4%; and some form of business mathematics occupies 11.8% of the total offerings. This leaves 33.5% for all other courses. The other courses include such titles as, review mathematics, refresher mathematics basic mathematics, functional mathematics (3 hours), high school mathematics. several titles for engineering mathematics, technical mathematics, farm and ranch mathematics, mechanical drawing, etc.

It is often difficult to judge the content of a course by the title it bears; however, it seems rather certain in this case that at least two-thirds of the mathematics courses offered are college preparatory. There seems to be little evidence to show that the remaining courses are designed for general education.

A careful study of the development of the junior college program shows rather conclusively that (1) the junior college is rapidly developing into the community college to provide two additional years of secondary education, (2) the general education function of the junior college is increasing in importance, (3) as regards the program in mathematics, it is still predominantly the college preparatory program.

It seems that the mathematics teachers have done very little to make mathematics function in the curriculum of the new American college. About the best that can be said is that about 65 to 75% of the courses are offered for about 25 to 33% of the students. On the side of vocational education, it should be remembered that vocational education requires competence other than occupational skills. The vocational needs define areas where the junior college can make a great contribution to the education of American youth. The experience of the writer would indicate that many boys ambitious to become aeronautical, electrical, mechanical, civil, or architectural engineers might be happier and more successful as technicians in the respective fields. In this connection, the mathematics teacher has a great responsibility. What is being done to meet the needs?

The writer should like to recommend that the National Council of Teachers of Mathematics assume the responsibility of making a thorough study of the place of mathematics in the junior college. Such a project should have at least four goals. First, there is need for a teacher-training program adequate to prepare teachers to teach terminal courses in mathematics for general education; second, the teacher-training institutions need to be awakened to the fact that they have not, in general, but must provide advanced degrees for teachers as well as research workers; third, the purpose of mathematics in general education on the junior college level should be clearly defined; fourth, the subject-matter content of mathematics for general education on the junior college level should be defined and outlined.

[11] Taken from work sheets used by Miss Henria Pepper in preparing a master's thesis on curricular offerings in public junior colleges in the Southern Association, University of Texas. The material was made available by Dr. C. C. Colvert, Chairman, Department of Educational Administration, University of Texas.

Group Affiliation with the National Council

By H. W. Charlesworth
Chairman of Affiliated Groups, East High School, Denver, Colorado

Progress of Affiliation Improvement

Affiliation is looking up! Reports from groups all over the country indicate great activity in the direction of the establishment of well organized state groups of teachers of mathematics. The numerous letters received show a definite and active interest on the part of leaders to effect sound and working organizations. I have seen copies of constitutions of newly organized groups and revised constitutions of older groups. They are very good. If you wish to know about these, write to me and I shall tell you about them. State representatives, under the able leadership of their chairman, Kenneth E. Brown, are helping a great deal. Officers and other members of the Board, headed by our hard working and efficient president, E. H. C. Hildebrandt, are boosting the efforts of improved affiliation. Some members of the Board are actually going out to meet with groups to help in organizational work. It is all very encouraging to me and points to the fact that very soon now we shall be operating under vastly improved affiliation conditions. Groups will be able to realize more help from the National Council and it will be more easily possible for groups to coordinate their efforts.

Have You Elected Your Delegate

As we have been saying, much can be accomplished at the Delegate Assembly in Chicago to crystallize our thinking and to bring about agreements on working regulations. Each affiliated group is entitled to send one delegate to the Delegate Assembly. We want to know who this person is to be. We need certain information about your delegate. Now is the time we have set for your group to send in this information. Don't wait for a letter from me about it, but send in the following information now: name of delegate, teaching position, mailing address, brief statement of his (or her) acquaintance with the group, brief statements of questions and matters that he has been instructed to present. If for any reason you cannot do this by March 15, please write to me and explain. We hope to have every affiliated group represented at the Delegate Assembly.

Renewal and New Affiliations

If your group has been affiliated with the National Council and desires to continue this relationship, you should fill out a renewal blank which you can secure from me. While we have asked for this to be done by December 1, renewals are acceptable any time. Although we have been stressing the organization of state groups and their affiliation with the National Council, we do not wish to exclude district or local groups or clubs of teachers of mathematics. We do not wish to include high school or college student groups in the present plan.

Newly organized groups may not be in a position to complete affiliation by March 1 and thereby gain the privilege of sending a delegate to the Delegate Assembly. We do not wish to be too strict about this. If organizational work has progressed far enough to assure the matter and it is the definite intention of the group to affiliate with the National Council as soon as possible, I see no objection to this group sending a delegate to the Delegate Assembly. If your group is in such a position and you are interested, please write to me about it. Again, we want all who are interested to share in this matter of improved affiliation.

Candidates for N.C.T.M. Offices—1950 Ballot

BELOW is a brief biographical sketch of each of the candidates whose names will appear on the ballot which all members will receive in March. The nominating committee has the permission of the candidates to present their names on the ballot. Two candidates are presented for each office to be filled. The names are listed alphabetically.

President

CHARLESWORTH, H. W. A.B. 1922, M.A. 1927, Colo. St. Coll. of Educ. Elem. tchr. 1 yr. Frederick, Colo.; prin. Jr. H.S. 3 yrs. Sugar, City, Colo.; supt. 3 yrs. Eads, Colo.; asst. prof. Math. 3 yrs. Colo. St. Coll. Educ.; Denver schools 21 yrs., present chm. of math. East High, Denver. *Mem:* N.E.A.; Colo. Educ. Assn.; C.A.S.M.T.; Math. Assn. of Amer.; member of board, second vice-pres., first vice-pres. N.C.T.M.; consultant Colo. St. Commission of Educ. for Life Adjustment; P.D.K.; K.D.P.; Univ. Civic Theatre; Denver Civic Symphony; Schoolmasters Guild; Trinity Methodist Church. Author: articles in Math. Tchr. and School Science and Math.; contributor to Eighteenth Yearbook. *Address:* 1546 Cook St., Denver 6, Colo.

WOOLSEY, EDITH. *b.* Minneapolis, Minn. B.A. 1913, M.S. 1947, Univ. of Minn. Math. tchr. in H.S. of Minn., 1913–20; Math. tchr. in Minneapolis Jr. H.S., 1920–26; tchr. and head of dept. in Sanford Jr. High, 1926–. Mem. Minneapolis curriculum coordinating council, 1947–50; secondary curriculum planning committee, 1946–47; Pres. Minn. Council of Math. Tchrs., 1948–; N.C.T.M., Board of Directors, 1934–40, st. representative, 1938–44, 1948–49, chm. of Jr. H.S. program committee, 1940–43, vice-pres., 1944–46; M.E.A.; N.E.A.; A.A.U.W. co-author: Algebra for Use; author: Curriculum tests for algebra. *Address:* 5415 Aldrich Ave. South, Minneapolis, 19 Minn.

Vice-President—Elementary Mathematics

JOHN, LENORE. *b.* Annville, Pa. B.A. 1921, York Coll.; M.A. 1927, Univ. of Chicago. Tchr. Neligh, Neb., 1921–22; Janesville, Wis., 1922–24; Univ. of Chicago Lab. School, 1927–; Summer teaching, Ia. St. Tchr. Coll.; Emory Univ.; Duke Univ. Mem. N.C.T.M.; Women's Math. Club of Chicago & Vicinity, program chm., 1948–49; C.A.S.M.T.; Amer. Educ. Research Assn.; Progressive Educ. Assn; League of Women Voters. Joint author, Vocabulary of Arith.; Living Arith.; a series of texts for the elementary grades; articles in the Elementary School Journal. *Address:* Laboratory School, Univ. of Chicago, Chicago 37, Ill.

HOLDER, LORENA. B.A. 1925, Univ. of Texas; M.A. 1940, Southern Methodist Univ. Dallas Independent School District, 1925– Arith. in grades, 4–8 (assignments vary). *Mem.* N.E.A.; N.C.T.A.; T.S.T.A.; D.C.T.A.; N.C.T.M.; served as recording sec., auditor, chm. of standing committees in the Dallas classroom Tchr. Assn.; member of Ethics Committee, N.E.A.; Committee Chm. in D.K.G.; Pres. of Dallas Intermediate Math. Club; Business & Professional Womans Club; Order of the Eastern Star (served as Worthy Matron). *Address:* 312 West Ninth St., Dallas 8, Tex.

Vice-President—High School Mathematics

CARPENTER, DALE. B.S. 1925, Ohio Northern Univ., Ada, Ohio. Tchr. Edison Jr. H.S., Los Angeles, 1928–37; tchr. Univ. H. S., Los Angeles, 1937–38; Math. Supervisor of Jr. & Sr. H.S., Los Angeles City School Districts, 1939–. Mem. N.C.T.M.; Calif. School Supervisors Assn.; Calif. Tchrs. Assn.; Life member of Univ. of Calif. Alumni Assn.; Calif. Council of Math. Tchrs., formerly Vice-pres. & Pres.; N.E.A.; A.A.A.S.; Calif. St. Sub-Committee on Math., 1940–42; Chairman of Los Angeles Comm. for College Preparatory Experimental Mathematics Program, 1947–48. Author: "An Evaluation of the College Preparatory Math. Program," The Calif. Math, Council Bulletin, Nov. 1946; "Planning a Secondary Math. Curriculum to Meet the Needs of All Students," The Math. Tchr., Jan. 1949; "Meeting Wartime Demand for Math.," Calif. Journal of Secondary Educ., May 1943, (reprinted in Educ. Digest); "The Experimental Coll. Preparatory Math. Program," Calif. Journal of Secondary Educ., Nov. 1948. *Address:* Math. Educ. Section, Los Angeles City Schools, Los Angeles, Calif.

PRICE, VERNON H. b. Keswich, Ia. B.A. 1931, St. Univ. of Ia.; M.S. 1935, Northwestern Univ.; Ph.D. 1940, St. Univ. of Ia. Tchr. of Math. Thornton Fractional Twp. H.S., Calumet City, Ill., 1931–34; Univ. H. S., Ia. City, Ia., 1934–(Head of dept. since 1940) Member of Dept. of Math., St. Univ. of Ia., Instructor, 1940–43; Assistant Prof., 1943–47; Associate Prof., 1947–. Nature of duties, Tchr.-training and experimental work, primarily at the secondary school level. Mem: N.C.T.M. (member of Commission on Post-War Plans); C.A.S.M.T. (Board of Directors, formerly Sec., Vice-Chm., Chm. of Math. Section); Iowa Assn. of Math. Tchr., (formerly Pres., Vice-Pres., Sec.-Treasurer, member of Board); Amer. Math. Society; Math. Assn. of Amer.; Amer. Assn. of Univ. Prof.; P.B.K.; Sigma Xi; Phi Delta Kappa. Author:

"Math. Clubs," The Math. Tchr., Nov. 1939; "We Can Remove the Stigma from General Math," School Science & Mathematics, May, 1947; "An Experiment in Fusing Plane and Solid Geometry," School Science and Mathematics, March 1949. *Address:* University H.S., Iowa City, Iowa.

Members of Board of Directors (Three to be elected)

Bernhard, Ida May. *b.* Sequin, Texas. B.A. 1931, Univ. of Texas; M.A. 1943, Univ. of Texas. Math. Tchr., Texas Public Schools, 1927–45; Supervisor of Math., Southwest Texas St. Tchr. Coll. Laboratory School, 1945–. Mem. N.E.A.; N.C.T.M.; Math. Assn. of Amer.; Texas St. Tchr. Assn.; Texas Classroom Tchr. Assn.; A.A.U.W.; Delta Kappa Gamma. *Address:* 331 West Hopkins, San Marcos, Tex.

Hach, Alice M. *b.* Ann Arbor, Mich. A.B. 1939, Univ. of Iowa; M.A. (completing work, June 1950), Univ. of Mich. Math. Tchr., Stuart Jr. H.S., Stuart, Ia., 1928–31; Head of Math. Dept. [Jr. H.S.], Fort Dodge, Iowa, 1931–42; Math. Tchr., Mitchell School, Racine, Wis., 1942–44; Math. Tchr., Slauson Jr. H.S., Ann Arbor, Mich., 1944–49; Math. Tchr., Univ. H.S., Ann Arbor, Mich., 1949–50; Asst. in Cost Dept., Horlick's Malted Milk Co., Racine, Wis., Summer 1943; Production Analysis, Borden's Milk & Ice Cream Co., Racine, Wis., Summer 1944. Mem.: N.C.T.M., District representative for Iowa; Iowa St. Math. Assn., Pres. & Vice-Pres.; Member Math. Curriculum Comm. for Iowa; N.E.A.; Mich. Educ. Assn.; Mich. School Masters' Club, sec.; Pi Lambda Theta; Delta Kappa Gamma, Treasurer; A.A.U.W. Author: "The Bulletin Board as a Pupil Activity," "Is Math. Popular?," articles in Iowa Math. Bulletin (Based on a survey). *Address:* 700 West Huron St., Ann Arbor, Mich.

Heard, Ida Mae. B.S. 1938, North Texas State; M.A. 1943, Teachers College, Columbia. Elementary Rural Schools, Harrison County, Texas, 1929–34; Math. Tchr. Jr. & Sr. H.S., Marshall, Texas, 1939–43; Math. Tchr. Jr. & Senior H.S., Maplewood, N. J., 1943–46; Asst. in Math. Dept. at Tchr. Coll., Columbia, Summer of 1946; Asst. Prof. of Math. at Southwestern Louisiana Institute, Lafayette, Louisiana, 1947–50. Mem. Pi Lambda Theta; Delta Kappa Gamma, Corresponding Sec.; A.A.U.W., Recording Sec.; N.C.T.M.; La.-Miss. Branch of N.C.T.M., Sec.; La. Educ. Assn.; C.A.S.M.T.; Lafayette Garden Club; Business Women's Circle of Presbyterian Church, first vice-pres. Co-author of "Just for Fun," with Z. L. Loflin, 1948; Author: "Vitalizing Math. Through Classroom Atmosphere," The Math. Tchr., Dec. 1942; "Stimulating the Study of Math. Through Special Interests," The Math. Tchr., Nov. 1948, Listed in Who's Who in the South and Southwest. *Address:* Box 352, Southwestern Louisiana Institute, Lafayette, La.

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Have You Heard?

By Edith Woolsey
Sanford Junior High School, Minneapolis, Minn.

The Denver mathematics teachers scored again. The summer meeting of the National Council of Teachers of Mathematics was at the University of Colorado in Denver from August 29 through September 1. This was the third meeting the Council has had there and, from reports that have reached us, was the most successful. Mrs. Alma B. Cockburn, who teaches at the Liggett School in Detroit, has written an account of the meeting for her school paper and it is being published here so all of you can share her enthusiasm.

"There were 385 mathematics teachers in attendance and they were from 35 states and the District of Columbia.

"After registering on August 29, and being welcomed most cordially, we were assigned to cars belonging to and driven by teachers from the Denver schools.

"We went to Buffalo Bill's grave and from Mt. Lookout, looked at the foothills and the town of Golden down below. Over winding mountain roads we arrived at Central City, scene of the earliest gold strikes in Colorado. We visited the famous Opera House, and the Teller Hotel with its diamond-dust mirrors, Battenberg curtains, and lovely old rosewood furniture. When General Grant visited Central City, enthusiastic citizens paved the street in front of the hotel with silver bars.

"After looking at 'The Face on the Bar Room Floor,' we went on to Idaho Springs, and up to Beautiful Echo Lake, and beyond to the timberline at 11,500 feet, where the trees are gnarled and distorted. At Red Rocks we ate a dinner of barbecued buffalo and were entertained by a program of square dancing and folk dancing in the amphitheater. This seats 10,000 people and is the most beautiful and awe-inspiring natural theater I have ever seen.

"For the next three days we had meetings—general addresses and discussions. We talked about 'The New Versus the Old,' 'Safety Taught Through Mathematics,' 'Mathematics in Industry,' 'Why Teach Geometry? Five Hundred Teachers Reply,' and other topics. Each day mathematical films were shown.

"At the banquet we were made welcome by the chancellor of the University. Professor Langer of the University of Wisconsin, President of the Mathematical Association of America, was the principal speaker. He urged special schools for superior students. He felt that these pupils should have a chance to develop their powers for, in later years, they should be the leaders of our country. In his opinion, we sorely need such leadership.

"Attending this conference helped me greatly. To see 385 people all vitally interested in teaching mathematics in the best possible way, was very heartening. You felt that each person was interested in the problems of all the others. Everyone was friendly. Dr. Hildebrandt, President of the National Council, wrote to Miss Ogden, telling her he was glad I was there. Hearing what they are doing in a classroom in Dallas, Texas, or in Los Angeles, California, gives me new ideas for my classroom in Detroit.

"Each morning in the Denver Post above the weather report, one reads, 'Tis a privilege to live in Colorado.' I should like to borrow this caption and say: ''Tis a privilege to be a teacher of mathematics who can attend a mathematics conference in Colorado or elsewhere'."

Are you going to be in Chicago for the convention of the National Council on April 12–15? A large group of Baltimore teachers will be there. By inquiring they discovered that they could get a substantial reduction in railroad fare if a party of twenty-five or more persons travelled together in each direction. Perhaps other railroads from other cities would make the same reduction in rates if they were informed about the convention. Whether you get a reduction or not, be sure to be there. This is going to be the finest, the most worthwhile meeting the Council has had. If you can go to only one Council meeting this year, make that one Chicago.

Miscellanea—Mathematical, Historical, Pedagogical

By Phillip S. Jones
University of Michigan, Ann Arbor, Mich.

Little Books

Permabooks (14 West 49th St., New York) has just published *Numerology, What is Your Lucky Number?* by Morris C. Goodman for thirty-five cents. The first chapter is historical, interesting, correct, but too short to be of much value. The rest is mystical mumbo-jumbo about time "cycles," "vibrancy," etc. There is only a little computation called for in the entire book, but if carefully used it has value as an interesting and enriching curiosity.

"Means" for an End

Since pointing out the use of arithmetic, geometric, and harmonic means in calculating $\sqrt{2}$ in both Babylonian and modern times,[1] the writer has had called to his attention two other uses of these concepts.

To emphasize the danger of depending on intuition, Richardson gives the following problems.[2]

1. If A can do a job in 6 days and B can do it in 10 days, how long will it take them to do it together?
2. A man sells 60 pieces of candy at 3 for 1 cent and another 60 pieces at 2 for 1 cent. Would his income be more, less, or the same if he sold 120 pieces at 5 for 2 cents?
3. A car travels 10 miles at 30 miles per hour and the next 10 miles at 60 miles per hour. Would the trip take more, less, or the same time if it traveled at the steady rate of 45 miles per hour?

In each of the above problems the student is asked to "answer intuitively" and then to check by calculation. In each it is apparently expected that the student will use the arithmetic mean and get respectively 8 days to do the job twice or 4 if they worked together; 5 for two cents, leading to the conclusion that his income would be the same; 45 miles per hour, implying that the total time at the uniform rate would be the same.

If one "calculates" he finds each of these "intuitive" (common sense?) answers to be wrong. If one had originally used the harmonic mean, $2ab(a+b)$, in each case he would have had: 15/2 days to do the job twice or $3\frac{3}{4}$ days working together; $2\frac{3}{4}$ pieces of candy per cent as the equivalent price (i.e., he would have had less income selling at 5 for two cents); 40 miles per hour as the equivalent uniform rate (i.e., he would have taken less time at 45 miles per hour).

The common features of all these problems are: (1) they contained three quantities (a job, a rate, and a number of days or time, rate and distance, or income, price, and number of pieces); (2) in each case one of these quantities was held fixed and one was a rate; (3) the two variables were inversely proportional.

The conclusion which can be established is: if one wishes to replace a set of different quantities by a single quantity which will represent the behavior of the entire set in a computation, one must determine what (if any) mean is to be chosen by considering the nature of the relationship being used.[3] If you wish to know the side of a new square which has an area equal

[1] The Mathematics Teacher, Vol. XLII (Oct., 1949), p. 207 ff.

[2] Moses Richardson, *Fundamentals of Mathematics.* (New York: Macmillan, 1941) p. 8.

[3] The means discussed here are of course only three of the "measures of central tendency." Others, plus the generalized statistical definitions of these three together with more discussion of their use may be found in John F. Kenney, *Mathematics of Statistics.* (D. Van Nostrand Co., 1939), Chap. III, "Averages," and F. E. Croxton and J. Cowden, *Applied General Statistics* (Prentice-Hall: 1946), Chap. 9, "Measures of Central Tendency."

to that of a rectangle of sides a and b, one takes not their arithmetic nor their harmonic mean, but their geometric mean, $\sqrt{ab}$. If one wishes the side of a single square, two of which will be equal in area to the sum of the areas of two squares of sides a and b respectively, one would take

$$\sqrt{\frac{a^2+b^2}{2}}.$$

This latter is the root mean square value which generalized by the calculus to

$$\sqrt{\frac{1}{b-a}\int_a^b [f(x)]^2dx}$$

is so important in dealing with alternating electrical currents. Differently generalized for discrete rather than for a continuous variable the "root mean square" becomes the well known standard deviation of the statisticians.

In other words, the question is whether Richardson's problems were really pointing out errors of intuition or common inadequacies of our instruction. We should not teach merely the computation of the arithmetic mean, but also something about when it may and when it may not be used. Teaching for understanding should include the concept that the appropriate mean is determined by the end which it is to serve.

A second use of the harmonic mean occurs without explicit recognition in a nice little pamphlet on simple air navigation.[4] The solution to the "Radius of Action from a Fixed Base" problem is given as

$$\frac{GsO \times GsB}{GsO+GsB}=RA$$

where GsO is the ground speed out and GsB is the ground speed back. Here we note that the distances are the same, and that we have a variable rate inversely proportional to the time. In the illustrative problem $GsO=62$ and $GsB=119$ giving RA (Radius of Action for one hour of flying time) of 41 miles. Had we used our harmonic mean formula we would have had 82 miles per hour as the constant rate at which we would have made the same trip in the same time. Hence if we were to fly only one hour and go out and come back the RA would be one half of 82 or 41 miles.

The above pamphlet gives a graphical solution also. This calls to mind the fact that our harmonic mean formula is just twice the value of z in the equation

$$\frac{1}{z}=\frac{1}{a}+\frac{1}{b}.$$

This latter is the generalized mathematical form for many physical relationships such as those involving capacitances and resistances in parallel in electrical circuits and the focal lengths of lenses. A graphical chart for solving this formula may be easily constructed as follows. Erect lines AB and CD perpendicular to line AC and on the same side of it. Lay off arithmetic (equally spaced) scales on both AB and CD. Take the distance a from A to E on AB and b from C to F on CD. Join A to F and C to E. The intersection of AF and CE will be at distance z from AC.[5] The proof of this is a simple exercise in parallels, similarity, and proportion, which puts some geometry in algebra and shows applications of both.

Historically: There is evidence for the use of averaging as a device in Babylonian and Egyptian geometry as well as in com-

[4] George Sidney Stanton, *Path of Flight.* Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., iv, 32 p., 40 cents. The subtitle is *Practical Information about Navigation of Private Aircraft.* A sample aeronautical chart is enclosed.

[5] This device has been described in many places; for example, *Q.S.T.*, Vol. 27 (October, 1943), p. 61. This monthly magazine for radio amateurs contains many usable elementary applications of mathematics. It's available on many newsstands and will repay browsing.

See also "A Graphical Solution of Some Common Problems," by John Colliton in THE MATHEMATICS TEACHER, Vol. XXXIX (Dec., 1946), p. 391.

puting $\sqrt{2}$.[6] The three *means* may be traced to Pythagoras' time. The word *average* first appeared about 1500 meaning an impost on goods. It then went through a series of changes in meaning: "Any charge in excess of the freight charges, payable by the owner of the goods"; "Loss to owners from damage at sea"; "Equitable distribution of such expense when shared by a group"; "Distribution of the aggregate inequalities of a series of things."[7] The writer has not yet found when the Pythagorean-Euclidean ideas of the means of two quantities were redefined to the present concepts of the means of any number of variates. Perhaps some one can help us here?

[6] J. L. Coolidge, *A History of Geometrical Methods.* (Oxford: 1940) pp. 7, 10.

[7] Helen M. Walker, ***Studies in the History of Statistical Method.*** (Baltimore: Williams and Wilkins, 1929), pp. 176, 183.

Membership Message

By Mary C. Rogers

Your National Council thanks you sincerely for your cooperation in providing information for this first listing of Membership Honor Schools. Yours is a very commendable initial response. It is quite probable, however, that a great many more of you qualify for such recognition but were unable to submit your reports during the time limit given you.

In order that you may be included in a second listing this school year, your Council is making its first report one month earlier than originally planned, and is announcing May 1950 as the date for publication of its second report.

Many new memberships have been coming in during recent weeks. The May listing of Membership Honor Schools should be a large one indeed. We shall be watching the mails for your membership reports. May we hear from you not later than March 15, 1950. Simply complete the accompanying form and mail it to

Miss Mary C. Rogers,
462 North Ave., East,
Westfield, New Jersey

Please accept our sincere thanks for your cooperation and assistance. Your Council deeply appreciates the increasingly strong interest and support of its number organizations and of the numerous individuals who make up those organizations.

MEMBERSHIP REPORT TO THE NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

School ______________________

School Address ______________________

____

Number of Teachers of Mathematics in Your School ______________________

Number of National Council Members

____

Report Submitted by ______________________

____

Your Address ______________________

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National Council of Teachers of Mathematics

Membership Record

100% Schools—as of December 15, 1949

1. Plant City, Florida	Mary L. Tomlin Junior High School
2. Atlanta, Illinois	Atlanta Community High School
3. Carterville, Illinois	Carterville Community High School
4. Casey, Illinois	Community High School
5. Freeport, Illinois	Freeport High School
6. Normal, Illinois	Illinois State Normal University
7. Minneapolis, Minnesota	University High School, University of Minnesota
8. Elizabeth, New Jersey	Battin High School
9. Jersey City, New Jersey	St. Michael's High School
10. Jersey City, New Jersey	State Teachers College
11. Montclair, New Jersey	State Teachers College
12. Pennington, New Jersey	Pennington School
13. Point Pleasant, New Jersey	Point Pleasant High School
14. Red Bank, New Jersey	Senior High School
15. Roselle, New Jersey	Harrison Elementary School
16. Rutherford, New Jersey	Fairleigh Dickinson Junior College
17. South Amboy, New Jersey	Harold G. Hoffman High School
18. Sussex, New Jersey	Sussex High School
19. Swedesboro, New Jersey	Swedesboro High School
20. Thomas, Oklahoma	Jabbok Bible School
21. Klamath Falls, Oregon	Klamath Union High School
22. Richmond, Virginia	Thomas Jefferson High School
23. Richmond, Virginia	John Marshall High School
24. Washington, D. C.	Central Junior-Senior High School
25. Washington, D. C.	Eliot Junior High School
26. Huntington, West Virginia	Vinson High School

"All but One" Schools—as of December 15, 1949

1. Waycross, Georgia	Center High School
2. Fairmont, Minnesota	Junior-Senior High School
3. Allentown, New Jersey	Upper Freehold Township High School
4. Bayonne, New Jersey	Bayonne Junior College
5. Burlington, New Jersey	Burlington High School
6. Convent Station, New Jersey	College of St. Elizabeth
7. Highland Park, New Jersey	Senior High School
8. Madison, New Jersey	Madison High School
9. Matawan, New Jersey	Matawan High School
10. Millville, New Jersey	Memorial High School
11. Mount Holly, New Jersey	Regional High School
12. Newark, New Jersey	State Teachers College
13. Rahway, New Jersey	Rahway High School
14. Summit, New Jersey	Kent Place School

The Need for Extending Arithmetical Learnings

By Ben A. Sueltz *and* John W. Benedick
State Teachers College, Cortland, N. Y.

An Unsatisfactory Situation

The current trend toward teaching arithmetic and mathematics for "meaning" and "understanding" coupled with the aim to achieve functional competence on the part of the pupil is causing reverberation among mathematics teachers. Teachers ask, "What and how much can pupils really understand?" and "Shall I teach this topic if I cannot find more than a few poor examples of functional usefulness?" While these questions do not represent the point of view of all teachers, they are indicative of a growing discontent with the achievement in mathematics at both the elementary and secondary school levels. Of course, people in business and industry, as well as representatives of the armed services in the late war, have repeatedly asked that curriculum workers and mathematics teachers do something (almost anything) that will educate the common citizen so that he has at least a modicum of competence in the mathematical situations with which he is repeatedly confronted.

This paper will be restricted to a discussion of arithmetic, the weaknesses of elementary and high school pupils therein, and proposals for remedy of the situation. Certain conclusions will be sustained by objective evidence, others will fall in the realm of personal opinion based upon a number of years of experience with pupils in the elementary and secondary schools and with college students.

What is Arithmetic?

We generally agree that, in the public schools, arithmetic is a study of the significance and uses of numbers in the social, cultural, economic, and industrial situations most commonly found in our society. This does not preclude a study of "the science of numbers" but rather provides that both the science of numbers and the algorisms of computation shall be important elements and stages in the study of arithmetic. In short, arithmetic is not restricted to abstractions but is a functioning part of each person's basic education which will enable him to accept a role of individual responsibility in society and also it provides him with the knowledge, understanding, skill, and judgment which society at large has a right to expect of one of its competent constituent members. Arithmetic uses numbers in many circumstances but, as now conceived in the public schools, arithmetic also encompasses many concepts, principles, and judgments in which numbers play a very minor role. Arithmetic is much more than the "number work" so often described in older courses of study.

Functional arithmetic in this discussion means all those types and phases of arithmetic which the general citizen, the nontechnical worker, has occasion to use in the pursuit of his social, cultural, and economic affairs. It includes such things as keeping the score on Bridge or Canasta, making estimates of time and distance, judgments of appropriate amounts, taking fractions and multiples of amounts, wise buying, thinking and calculating per cents, keeping records and accounts, interpreting graphs and charts, understanding the significance of small and large numbers, and understanding and calculating such things as taxes, insurance, and investments. Functional arithmetic is very broad. Frequently it is primarily concerned with arithmetic facts, concepts, and principles with very little computation. It involves stages of individual participation in a situation: (a) sensing and recognizing the essential mathematics in a situation, (b)

knowing how to think through the situation and what to do mathematically, (c) being able to reach a valid conclusion including the necessary computations, and (d) feeling the need for verifying and being able to verify conclusions.

A casual analysis will show that arithmetic, broadly conceived, is important to both algebra and geometry. It is not merely the number aspect; it is also the facts, concepts, and principles of arithmetic that are employed in a functional program of algebra and geometry. The following discussion will be restricted to the use of arithmetic as defined above and not in relation to other segments of the field of mathematics.

Arithmetic in the Elementary School, Grades 1–6

Recent courses of study in arithmetic strongly urge teaching for meaning and understanding. Grade placement has changed little in the past ten years. In some sections of the country actual total learning of arithmetic has dropped. In certain schools real progress is being made toward "meaningful learning" particularly in terms of concepts and uses of arithmetic; however, in some of these schools pupils are not achieving a satisfactory level of facility and accuracy with computations. In some sections there is a growing trend toward "experience curricula" with varied results in arithmetic depending upon the wisdom and judgment of the teachers concerned.

Tests given to more than two thousand pupils in grade six in three states in the Eastern area show the following weaknesses in arithmetic:

In computations: (1) basic number combinations in all processes; (2) all computations with whole numbers when exercises were not simple or very short; (5) all but the very easy exercises with common fractions; (4) decimal fractions where shifts of the point were involved; and (5) computations with measures when changes had to be made from one unit to another.

In Problems: (1) the "will" to read and understand even simple statements; (2) sensing the essential mathematics of a situation; (3) judgment of associating a process with a situation; (4) errors in computation, in copying figures, from "messy work," and in short cuts arising from "being smart."

In Understanding: (1) basic concepts of whole numbers, fractions, and measures; (2) principles and relationships of fractions, and of measures; (3) the essential mathematical process inherent in common situations; (4) number relationships within a process and the relationship of one process to another.

In Judgments: (1) size of common units of measure and of familiar items to be measured; (2) fractional relationships with real things and with pictorial figures; (3) common economic and social information and principles; (4) why and when to use one process rather than another for economy of time and energy; (5) orderly arrangement and sequence.

These weaknesses, found at the end of grade six, are pointed out at this time in order to show that at this level children do not possess and schools do not expect them to possess arithmetical abilities that make them functionally competent beyond the simplest understandings, judgments, and computational abilities. *The job of providing competence in arithmetic falls beyond the sixth grade level.* Schools must face the situation. It is not a matter of redoing or improving the work of grades one through six. Rather it is a job of extending arithmetical learnings in the junior and senior high schools.

Arithmetic in the Junior High School

In general the junior high school grades (7–9) include arithmetic as the larger portion of work in grades seven and eight and a lesser portion in grade nine. The point of view toward arithmetic in these schools tends to fall into either of two general types: (a) the continuation of a type of learning in which arithmetic is viewed

as the most important and useful part of mathematics for most pupils and (b) the view of arithmetic as a mathematical tool related to other elements of mathematics such as algebra and geometry. The former group includes many teachers with limited training in college mathematics and who have tended to enter junior high school teaching from an older elementary school pattern. The second group includes many teachers who have more mathematical training and perhaps limited experience in teaching arithmetic to younger children.

Both of these groups can do a good job of extending arithmetic learnings so that pupils learn with meaning and understanding and so that they become alert to and functional with the arithmetic that a general citizen ought to know. However, a really good job is not being done. Evidence to support this statement will be given presently. In too many school systems little attention is given to articulation between the elementary school and the secondary school. Wide divergence in terms of basic philosophy, of standards of work and achievement, and in methods of teaching and learning exist. A few short weeks in the summer of a 12-year old child cannot bridge this divergence. It is sad for the children and yet the schools exist for education of these children.

The junior high school grades are not achieving a satisfactory level of arithmetic. More than one thousand pupils near the end of grade nine in three states in the Eastern Area were given tests designed to measure functional uses of mathematics. The following weaknesses were evident in 30% or more of the test results:

In computation: (1) the longer and "harder" multiplications and divisions with whole numbers; (2) all except the easier and shorter exercises with common fractions; (3) all except the simpler types of multiplication and division with decimal fractions; (4) all except the simple types of multiplying measures; (5) all except the simple cases of changing common fractions to decimals and to per cents and the reverses of these; and (6) all but the simple types of exercises in the three main cases of percentage.

In problems: (1) lack of careful and critical reading; (2) failure to recognize and to grasp the mathematics in a situation; (3) lack of systematic procedure and consequent "jumbling"; (4) computational errors of many types; and (5) failure to sense reasonableness and to use judgment in terms of procedure and answer.

In understandings: (1) principles of the number system when extended to large amounts and to "rounding"; (2) principles of fractions except in almost obvious cases; (3) principles of decimal fractions except in simple cases; (5) ratios and proportions except in simple cases; (6) relationships of numbers in computational processes, and (7) business relationships and business forms.

In judgments: (1) size, quantity, and amount of common commodities; (2) of common prices, values (wise buying), and of modes of buying and selling commodities; (3) of answers, both step or partial and final, in terms of numbers and situations; (4) of necessary and sufficient data for a conclusion; (5) of a visual impression where arithmetic as well as simple geometric form are apparent; and (6) of ratios and resultant per cents and of the relation of ratios to other ratios.

From the above it is apparent that: (a) many of the weaknesses found at the ninth grade level are extensions of learnings begun in the elementary school and (b) that we are not doing a good job in achieving these extensions in the junior high school. A casual review of textbooks designed for the elementary school and of the arithmetic in junior high school texts shows that the exercises and problems are "set-ups" in that the situations and numbers are chosen so that "things work out easily." Such an arrangement in a textbook is defensible because the book is intended to be an avenue for learning. However, the arithmetic of life is not always a "set-up," the numbers as well

as the situations are sometimes complex.

The Arithmetic of High School Graduates

In order to determine the arithmetic abilities of high school graduates, tests of of mathematical understanding and judgment (the same tests as used on the ninth-grade level) were given to nearly one thousand college freshmen. These freshmen, in terms of mean and standard deviation as determined by the Psychological Examination of the American Council on Education, were almost exactly the same as the national group of freshmen. College freshmen were also asked to rate themselves on a chick list of functional arithmetic and to do this in terms of (a) concepts and principles, (b) skills and computations, and (c) uses and applications of arithmetic. From these two groups of information the following weaknesses are apparent:

In computations: 1. multiplication and division with numbers between zero and one; 2. subtraction of mixed numbers where fraction in subtrahend is larger than fraction in minuend; 3. computations with measures where "changes" had to be made; 4. all cases of percentage where per cents are less than 1% or greater than 100%; and 5. special cases of handling decimal point in both ordinary decimals and in percentage.

In problems: 1. failure to identify and grasp the situation; 2. lack of systematic procedure and organization; 3. failure to recognize the essential quantitative relationships which give a clue to a correct procedure; and 4. failure to bridge from a textbook problem to a real situation.

In understanding: 1. The number system, including significance of large amounts, principle of place value, and rounding numbers; 2. relationships of numbers within processes with consequent lack of understanding and resourcefulness; 3. extended use of principles of common and decimal fractions; 4. understanding and relationships of fractions, decimals, and per cents in the less simple types; 5. relationships within the metric system except simple direct cases; 6. relationships of one case of percentage to other cases; and 7. business forms and procedures.

In judgment: 1. of what to do in steps of computation and with answers in terms of "significance" of numbers; 2. of reasonableness of answers and how to determine this; 3. of what can and what cannot be compared in ratios; 4. of the relation of an approximation to sufficiency for an answer in terms of the situation; 5. of size or capacity of visual amounts; 6. of necessary and sufficient data to draw a conclusion; and 7. of socio-economic principles applied to arithmetic.

What Can Be Done About the Situation?

The evidence points clearly that we are not achieving functional competence in arithmetic at the elementary school level, at the junior high school level, and at the senior high school level. Many teachers and lay people are convinced that arithmetic is by far the most functionally useful part of mathematics for the general citizen and that it is also of great value to the technical worker. An analysis of functional arithmetic shows that much of it has a distinct adult appeal in terms of the situations in which it arises. It is also true that functional arithmetic often deals with a mathematical content which is an extension of the more simple "set-ups" which of necessity must be used in the early stages of learning arithmetic. Where will functional competence be achieved?

In many schools, arithmetic has been directed largely to building facility with computations and then using these computations in written problems. This may or may not lead to functional competence depending upon the methods of learning and the scope of work done by the pupils. The crux of achieving meaningful learning and functional competence seems to lie in the teachers because they very largely

determine both the curriculum and the methods of teaching and learning. Until teachers generally want to work for such elements of arithmetic as concepts and information, principles and relationships, and understandings and judgments as well as abstract computations and textbook problems, functional competence will not be achieved. Here is a selling job that needs to be done.

The junior and senior high schools should include arithmetic as an integral part of the program of mathematics and not merely as an incidental phase. Some states are now doing this as for example as indicated in the newly released syllabi for New York State. In other localities, pupils are urged to study commercial arithmetic. This is a help, but the typical course in commercial arithmetic lacks inclusiveness. In still other schools a "two-track" program of mathematics is begun in the ninth grade. In such a program "track one" usually consists largely of algebra while "track two" frequently contains a large body of "practical arithmetic." The two tracks serve different populations with the one aiming toward a sequential and more technical program of mathematics while the other attempts to serve the more "work-a-day" needs and interests of pupils who probably will not attend college or technical school. The two-track program probably is doing the best current job in serving the needs and capabilities of pupils.

To extend arithmetic effectively a combination of all pertinent factors is needed. These are (a) teachers with vision, understanding, and judgment, (b) courses of study that direct the teachers' work toward functional arithmetic, and (c) a spirit and philosophy of education that makes it possible for a teacher to achieve worthwhile goals. It is important that the job be done better than now is the case.

AIDS TO TEACHING

By

Henry W. Syer
School of Education
Boston University
Boston, Massachusetts

Donovan A. Johnson
College of Education
University of Minnesota
Minneapolis, Minnesota

CHARTS

C.13—*Logarithm Chart* (12055)

Central Scientific Co., 1700 Irving Park Road, Chicago 13, Illinois, $10\frac{1}{2}\times 14''$, \$.25.

Description: The logarithms of numbers ranging from 10 to 999 are printed in two columns upon a white cardboard chart; the two-column arrangement of the logarithms is similar to that employed in many texts. Tables of proportional parts are included to simplify interpolation. The numerical values are printed in large clear type.

A number of conversion factors are listed at the bottom of the table; among those included are values of π, log π, e, and logxe. The rear side of the chart contains tables for determining density, volume, and pressure of gases under given conditions.

Metal eyelets have been inserted at the top of the tables to allow hanging in a convenient place for reference.

Appraisal: The chart is useful in cases where either the teacher or students do many problems involving logarithms at the blackboard. It is not, however, sufficiently large to be used for display when the concepts concerning logarithms are being used.

The superfluous information contained obviously indicates that the chart is of primary value in the physics or chemistry laboratory—especially when the texts in use do not contain such tables. It will be of little use to most mathematics teachers but is well worth the expenditure when needed. (Reviewed by Bernard Singer, Hyannis, Mass.)

FILMS

F.45—*Geometry and You*

Coronet Films, Coronet Building, Chicago 1, Illinois. 1949. 16 mm. film; black and white, or color; sound; 400 feet, 10 minutes; \$45 (BW), \$90 (Color)

Collaborator: Harold P. Fawcett.

Content: Two boys, Walter and Henry are enthusiastically studying the model of their new home. They want to add a porch to the home, so they test it out on the model. In cutting out the cardboard porch, compasses, straightedge, protractor, and scale are needed. They have a bit of difficulty in constructing similar and congruent triangles, but by proper application of basic theorems, the boys master their problems. Their experience here gives the student a clear conception of similarity and congruency. When the porch is completed, the boys examine it carefully to see how it blends in with the rest of the house. They imagine certain lines through the house, and they see that there is a certain balance to it. This is symmetry. And there are several axes of symmetry throughout the house. By angular measure, the boys determine the arc the sun will take; and by moving a lamp in this arc, they assure themselves that the porch will not shut out the winter sun from the house. By proper use of their tools and a few laws of Geometry, they have found the answers to their questions.

Appraisal: Henry, the artist, and Walter, the geometer, go about their task with natural zest and interest. Here is a film that actually does add a fresh outlook to Geometry. It demonstrates a few real living applications of Plane Geometry rather than depicting many of its wonders. The tenth-grade student can see himself in this film and can marvel at the immediate use to which he can put these basic principles of Geometry. This is a film that lucidly illustrates Geometry of design, use of tools, definition of terms, similarity and congruency, symmetry and space relationships, in a catching manner to the student. The photography and dialogue are well done; however, the commentary is at times too lengthy. (Reviewed by Robert J. Jones, Cambridge School, Weston, Massachusetts.)

F.46—*Periodic Functions*

Castle Films, Division of World Films Inc., 1445 Park Avenue, New York 29, New York.

U. S. Navy Training Film; Radio Technician Series; 16 mm. film; black and white; sound, 17 minutes; $23.54, list 10% to schools.

Content: This film introduces the sine function through its relation to two electric generators each producing 60 volts but when put together only producing 85 volts. The point, vector and angle are then introduced with the vector becoming the radius of a unit circle. The sine function is then developed through the perpendicular to the horizontal diameter. A rider is then chosen on the vector and a pointer takes a position on a scale of 1 to −1 such that the sine of the angle can be read from the scale. This pointer also serves to draw the sine curve when the paper is moved uniformly in a horizontal direction. This description is then followed by a schematic drawing of generators and their sine curves. These are then added in phase, 90 degrees out of phase, etc. The last section shows the curve and why the two generators only produced 85 volts.

Appraisal: This film is well done from an interest point of view. It was probably produced primarily for a physics class, but the first one half is very valuable for either trigonometry or the third semester of algebra. Its value would come as an introduction to sine functions because the film gives very clearly the idea of function in relating it to the angle and the one-half chord. The commentary is good and adds to understanding. It would no doubt encourage pupils to make mechanical devices which would trace the sine curve. The physics class would be tempted to test generators and voltage in relation to phase angles. It has student appeal and, at the same time, aids him in understanding the sine function and some of its uses.

This is a better than average teaching film, puts purpose into functions, and shows continuity in mathematics and science. (Reviewed by Philip Peak, University School Indiana University, Bloomington, Indiana.)

FILMSTRIPS

FS.62—*Plotting Graphs*

The Jam Handy Organization, 2900 East Grand Blvd, Detroit, Michigan. 1943; 35 mm. filmstrip; black and white; silent; 70 frames; $4.

Content: Graphs and Equations, linear equations, slope and intercepts, simultaneous linear equations, quadratic equations, and applications to mapping are the topics presented. The example of the formula for changing the reading of the Centigrade thermometer to Fahrenheit is used to illustrate the general form of the equation $y=ax+b$. The slope of a line and the intercepts are explained using this general equation. Two ways of solving a system of simultaneous equations by graphing are shown: drawing the curve with a slope; and plotting by choosing some convenient values for "x" and finding the corresponding values for "y"

according to the equation. Graphs of the simplest forms of second degree equations are illustrated. The strip is concluded with some examples of how graphs are used in navigation and mapping.

Appraisal: The photography is generally good except for some printing in white letters, which is difficult to read. The first thirteen frames may readily follow the showing of the filmstrips, "Graph Uses." The next nine frames, which present slope and intercepts, will facilitate teaching these concepts. The graphs showing the change in the parabola when "*a*," "*b*," or "*c*" have different values will speed illustrations during teaching. Graphs explaining other second degree equations are not covered as completely as the parabola. The illustrations of how graphs are used in navigation and mapping are brief. The filmstrip will aid in developing clearer understandings of the idea of relationship, of constructing various types of graphs, of solving problems, and of uses of graphs. It is useful both during teaching and during reviews. (Reviewed by Ida May Bernhard, San Marcos High School, San Marcos, Texas.)

FS.63—*Similar Polygons*

Society for Visual Education, 100 East Ohio Street, Chicago, Illinois. 35 mm. filmstrip; black and white; silent; 48 frames; $3.

Content: The filmstrip proposes to answer three questions: What are similar polygons? Where are they used? How can they be recognized? Similar polygons are defined and illustrated with several frames being devoted to recognition of such figures. The triangle is given special emphasis. Maps, scale drawings, structural design, image in a camera and finding heights and distances are pictured as uses of similar polygons. The proportional dividers and the pantograph are shown. A dozen frames at the end of the filmstrip are used for questions and answers.

Appraisal: The chief value of this filmstrip probably lies in indicating uses of similar polygons. The student would need to be very familiar with the basic theorems of similarity to discuss and understand the applications given. Only a few frames give sufficient detail for such discussion. No attempt is made to show how the proportional dividers and the pantograph work.

If used as an introduction to similar polygons, most classes would find defining, recognizing and applying too much for one lesson. On the other hand, if the pupils are familiar with these figures the frames on defining and recognizing are unnecessary. Greater usefulness might have been achieved with a more complete treatment of applications only.

The level is junior and senior high school. (Reviewed by Frances Burns, Oneida High School, Oneida, New York.)

FS.64—*Exponents and Logarithms*

The Jam Handy Organization, 230 North Michigan Avenue, Chicago, Illinois. 1943; $4.

This filmstrip can be used in high school algebra, high school trigonometry, college algebra, college trigonometry, and teacher training classes. The reviewer used this filmstrip in a college trigonometry class having twenty-eight pupils.

The following is an outline of the main topics according to order of appearance and number of frames devoted to each topic:

- I. Meaning of Exponents (3–18)
  - A. Introduction—three formulas which show the use of exponents (3–5)
  - B. The two types of exponents (7–18)
- II. Adding and Subtracting Powers (19–21)
  - A. The "basic rule" of like units (19–21)
- III. Multiplying powers (22–27)
  - A. Coefficient is not a part of the power or root. (22)
  - B. Definition of a factor (23–24)
  - C. Applying the factor method of multiplying numbers with different co-efficients (25–27)
- IV. Dividing of Powers (28–47)
  - A. Division is the inverse of multiplication (29–30)
  - B. The factor method of division is used for multiplying numbers having exponents (31–32)

C. Definition of zero and negative exponent (33–35)
D. The use of exponents (36–47)

V. Operations with Logarithms (48–87)
A. Introduction (48–51)
B. Using two as the base (52–53)
C. Reason for using ten as the base (54–55)
D. Finding the logarithm of numbers between 10 and 100, 100 and 1000, and so on, when the base is ten (59–64)
E. Methods of finding logarithms quickly and using them accurately (65–81)
F. Elementary operations with logarithms (82–87)

All of the ideas in this filmstrip are important and correlate well with the curriculum. Also, the reason for the filmstrip is very evident—review. However, the reviewer would hesitate before using this film in his classroom a second time. There are several ideas in the filmstrip which the writer would not care to use in his explanations. For example, frames 4, 5, 11, 14, 15, 16, 41, 48 and 84 use the terminology "times itself" in explaining the operation of raising to a power. Frames 6 and 17 show "the behavior of exponents" indicating that exponents actually do something; whereas, they only indicate an operation to be performed if we care to do it.

Two kinds of powers are described—"exponents and radicals"—in frames 7 and 13. Radicals are not exponents. A radical expression may be written as an exponential expression but the two are not the same. Frame 28 states that division is the "opposite" of multiplication. Frame 30 reduces fractions by "cancellation" and does not indicate the division process. Frame 37 introduces too many definitions for a satisfactory review. Frame 45 claims that the square root of 25 is plus 5 or negative 5. A plus square root of 25 is defined in algebra as the positive root—5. Frames 68 and 73 could clarify logarithmic usage if scientific notation were used. Frame 75 has a confusing picture of the characteristic and mantissa.

The vocabulary and maturity of approach is slightly inadequate for college students and not authentic for any grade level. It would require between one and a half to two hours to utilize the filmstrip properly and, on the whole, there is too much material on each frame.

Interest was not aroused in the college trigonometry class nor in the instructor. The illustrations were not outstanding.

The filmstrip did not lead to any learning activities and, except for three frames, the students and instructor felt that the filmstrip was a waste of time. (Reviewed by Perry Chapdelaine, Mason City, Iowa.)

INSTRUMENTS

I.17—*Speed-up Geometry Ruler*

Speed-up Geometry Ruler Co., 2206 Elsinor Avenue, Baltimore 16, Maryland. $4\times 8\frac{1}{4}''$; \$1.00 each, (\$.75 each for 2 to 5, \$.65 each for 6 to 99, \$.60 for 100 or more).

Description: The rectangular celluloid templet is a sturdy drawing instrument. Its left side contains an eight-inch ruler calibrated to sixteenths of an inch and the right side contains a twenty-centimeter rule graduated in millimeters. Fourteen cut-outs simplify the drawing of geometric plane figures. Half of this number is devoted to equilateral, isosceles, and scalene triangles; the other half includes a square, rhombus, four regular polygons, and a pair of similar irregular polygons. The figures vary in height from two inches to three and one quarter inches. The base of the stencil contains a semi-circular protractor with markings at one-degree intervals. No hole is provided at the vertex of the protractor so it becomes difficult to represent angles accurately.

The stencil is accurately cut; its figures have smooth boundaries. Each of the figures is lettered and has a number which may serve to identify it in class discussions. The numbers may be justified but the letters serve only to give the templet a crowded appearance. All of the lines and lettering have been impressed on the surface of the templet and will become invisible when the black ink has become rubbed out with use.

The stencil's transparency is an asset

in drawing figures whose sizes vary from those cut out of the celluloid.

Appraisal: Students may find this drawing aid useful for reproducing good geometric diagrams quickly. Each of these geometric forms may, however, be easily drawn with the aid of a protractor and straight-edge. Such "freehand" drawing is to be desired.

The metric scale is a desirable feature. It may be used to indicate the relationship between its units of measurement and those of the English scale at the other side of the templet.

The educational advantages of the stencil do not seem to be proportional to the price unless many neat figures must be drawn quickly. (Reviewed by Bernard Singer, Hyannis, Massachusetts.)

MODELS

M.10—*Dissectible Cone* (74115)

Central Scientific Company, 1700 Irving Park Road, Chicago 13, Illinois. 9″ high, 6″ diameter; $9.00.

Description: The model consists of a cone constructed of five pieces of polished hardwoods—black walnut, cherry, and maple. The sections are connected by heavy metal dowels; the model may be easily disassembled to show circular, elliptical, parabolic, and hyperbolic sections.

The model is 9 inches high and the circular base is 6 inches in diameter. The size is excellent for demonstration purposes. The contrasting colors of the different woods emphasize the angles at which the sections are cut. The model is attractively finished and is sturdy enough to last a good many years with proper handling. The dowels are effective in holding the sections together while still allowing easy separation of parts.

Appraisal: The aid is useful for explaining the conic sections in Algebra II courses. It serves a similar purpose in Solid Geometry where emphasis is laid upon the four angles at which a plane may intersect a cone to produce the various conic sections. This model can be used to eliminate any misunderstandings which arise during verbal descriptions of intersecting planes and cones.

It is constructed primarily for use as a demonstration device; it may well be demonstrated on a table for several days in order to allow students to become familiar with the four angles at which the sections are cut.

The price of the cone is somewhat high but it is a valuable addition to any mathematics collection and should be considered when school funds will permit. (Reviewed by Bernard Singer, Hyannis, Massachusetts.)

PLANS FOR CONSTRUCTION

PC.4—*Patterns of Polyhedrons*

Miles C. Hartley, University High School, University of Illinois, Urbana, Illinois.

Booklet of Patterns; $8\frac{3}{8}''\times 10\frac{3}{4}''$; 45 pages; $1.25.

Description: Seven pages are devoted to a classification and description of the five regular polyhedrons, and of 15 semiregular or Archimedean polyhedrons, of 57 other polyhedrons, and of 23 forms of crystals. The remaining 38 pages contain the patterns for the 100 polyhedrons, showing the tabs necessary to hold them together, and the creases marked to indicate whether it is a convex or a concave fold.

Appraisal: The stark, plane patterns of these polyhedrons do not begin to indicate the beauty of them when they are completed or the amount of plane geometry, as well as solid, that can be learned from their construction. The first view of some is confusing and even frightening, but the shapes fall in position easily and rapily once cut out. It takes some manual dexterity, which is not often enough provided for in mathematics classes, and a considerable appreciation of accuracy of measure and cutting to complete tight models, but who can say that accuracy is not the concern of mathematics! The

analysis and connectivity of the parts has been done in this booklet, and for many that is the hardest part of the construction. Most of the patterns are smaller than desirable, since difficulty and relative importance of accuracy vary inversely with size, but can easily be enlarged. In fact, the enlargement of the patterns and the attempts to originate new, similar patterns may be two of the most useful learning activities with these patterns. Do not neglect the use of colored cardboard or poster paint to enliven the results.

SOURCES OF MATERIAL FOR LABORATORY WORK

SL.16—*Castolite*

The Castolite Company, Woodstock, Illinois.

Plastics; special kit; $3.95; Master Kit, $7.75.

Description: Castolite is a transparent casting plastic. At room temperature it is a clear liquid that pours like syrup and sets solid like glass. It can be sawed, carved, or polished to a high surface gloss. It can be used to embed objects, preserving them in their original form, texture, and color, or to mold shapes or objects.

Appraisal: This is a versatile plastic material that has considerable promise for the novice to use in making models or displays for the classroom. Since castings can be completed in thirty minutes or less, it may be used for classroom projects. It can be worked without high temperatures, pressures, or expensive equipment. However, it is necessary to follow instructions very carefully to obtain good results. Mathematics teachers who are interested in exhibits, models, or simple devices will want to investigate the possibilities of this material.

The National Council of Teachers of Mathematics
Twenty-Eighth Annual Meeting

Congress Hotel, Chicago, Illinois
April 12, 13, 14 and 15, 1950

WEDNESDAY, APRIL 12, 1950

9:00 A.M. Meeting of the Board of Directors of the National Council of Teachers of Mathematics—Parlor K

2:00 P.M. Meeting of the Board of Directors—Parlor K

7:30 P.M. Meeting of the Board of Directors—Parlor K

3:30–9:00 P.M. Registration—Francis I Room

A.M. and P.M. *Visit to Chicago Schools*

Those interested in visiting any type of school may either send requests in advance to Miss Bernice L. von Horn, Hyde Park High School, 6220 So. Stony Island Avenue, Chicago 37, Illinois, or secure detailed information at the registration desk.

THURSDAY, APRIL 13, 1950

8:00 A.M. to 9:00 P.M. Registration—Francis I Room

A.M. and P.M. *Visit to Chicago Schools* (See announcement above)

9:00 A.M. Delegate Assembly—Meeting of official delegates of affiliated groups of the National Council of Teachers of Mathematics—Walnut Room

1:00 P.M. to 5:00 P.M. Sightseeing Trip and Visit to Museum of Science and Industry and Adler Planetarium. Buses will leave Congress Hotel at 1:00 P.M. See announcement regarding reservations at end of program.

1:15 P.M. Mathematics Tournament—Gold Room

Public Demonstration presented by Woodrow Wilson Branch, Chicago City Junior College, Edna M. Feltges, presiding. Members of the audience should be in their seats by 1:15 P.M. Late arrivals will be seated during recesses in Tournament.

3:30 P.M. General Business Meeting of the National Council of Teachers of Mathematics—Walnut Room

5:30 P.M. Reeve Gang and Teachers College Alumni Dinner. (See announcement at end of Program.)

7:45 P.M. General Meeting (Elementary Section)—Casino Room

Teaching for Meaning and Understanding Is Not Easy

C. L. Thiele, Divisional Director, Exact Sciences, Detroit Public Schools, Detroit, Michigan

The Romance of Number

Foster E. Grossnickle, State Teachers College, Jersey City, New Jersey

7:45 P.M. General Meeting (Secondary Section)—Gold Room

Is the Common Learnings Course Part of the Answer?

H. C. Hand, College of Education, University of Illinois, Urbana, Illinois

The Role of Mathematics in a Common Learnings Program

Harold Fawcett, Chairman, Department of Education, Ohio State University, Columbus, Ohio

Discussion

9:30 to 10:30 P.M. Reception

FRIDAY, APRIL 14, 1950

8:00 A.M. to 9:00 P.M. Registration—Francis I Room

7:30 A.M. Breakfasts (see announcements at end of program)

1. Fawcett's Ohio Staters
2. Duke Mathematics Institute Reunion

8:30 to 10:00 A.M. Mathematics Filmstrips—Parlors A and B

9:00 to 10:15 A.M. General Address followed by Discussion (Elementary School)—Walnut and English Rooms

The Diagnosis and Treatment of Learning Difficulties in Arithmetic

Leo J. Brueckner, College of Education, University of Minnesota, Minneapolis, Minnesota

9:00 to 10:15 A.M. Class-Demonstration (Upper Grades-Junior High School)—Gold Room

Henry W. Syer, School of Education, Boston University, Boston, Massachusetts

9:00 to 10:15 A.M. General Address followed by Discussion (Secondary School)—Casino Room

Removing the Roadblocks from the Path of Mathematics

William Betz, Specialist in Mathematics, Rochester, New York

10:30 A.M. to 12 M. Elementary School Section—Pine Room

Experiments in Arithmetic

Lorena Holder, Dallas Public Schools, Dallas, Texas

Helping Pupils Develop Meanings in Arithmetic

E. T. McSwain, Dean of the University College, Northwestern University, Chicago, Illinois

10:30 A.M. to 12 M. Junior High School Section—Walnut Room

Mathematics Teachers Train Thrifty Citizens

Jarvis M. Morse, Education Director, U. S. Savings Bonds Division, Treasury Department, Washington, D. C.

What is the Place of an Inductive-Laboratory Approach in Junior High School Mathematics?

John J. Kinsella, New York University, New York, New York

10:30 A.M. to 12 M. Secondary School Section—Casino Room

Aids in the Study of Algebra

W. W. Rankin, Duke University, Durham, North Carolina

Complex Numbers and the Growth of Mathematical Thought

Phillip S. Jones, University of Michigan, Ann Arbor, Michigan

10:30 A.M. to 12 M. Panel on Guidance in the Teaching of Mathematics—Casino Foyer

Leader: Raleigh Schorling, University of Michigan, Ann Arbor, Michigan

10:30 A.M. to 12 M. Junior College and College Section—Parliament Room

A Plan to Prepare *All* Beginning Students in College Mathematics for Calculus in Two Semesters

Kenneth W. Wegner, Registrar and Associate Professor of Mathematics, Carleton College, Northfield, Minnesota

Critical Thinking in College Freshman Mathematics

J. Houston Banks, George Peabody College for Teachers, Nashville, Tennessee

10:30 A.M. to 12 M. In-Service Training—Parlor G

Resourceful Teaching of Mathematics

William L. Schaaf, Brooklyn College, Brooklyn, New York

Temporal and Permanent Residuals of Good Teaching

Miles C. Hartley, University of Illinois, Chicago, Illinois

10:30 A.M. to 12 M. Kappa Mu Epsilon, National Honorary Mathematics Fraternity Meeting sponsored by Illinois Gamma Chapter, Chicago Teachers College, Professor J. M. Sachs, Advisor. Parlor F

1. Opening remarks by the President of Illinois Gamma
2. Student papers

10:30 A.M. to 12 M. Discussion Groups and Clinics

(Reservations for attendance and participation should be made in advance)

Group A1. Parlor D. Topic: What is a Good Program for General Mathematics in the Junior and Senior High School? (Grades 9–12)

Leader: A. Brown Miller, West Technical High School, Cleveland, Ohio

Group A2. Parlor E. Topic: Meeting Individual Needs in the Senior High School

Leader: M. Cottell Gregory, Louisville Girls High School, Louisville, Kentucky

Group A3. Parlor I. Topic: A Demonstration and Discussion of a Series of Devices for Making Concrete and Real Certain Types of Variation in Elementary Algebra

Leader: Sheldon S. Myers, University High School, Ohio State University, Columbus, Ohio

Group A4. Parlor J. Topic: The Cooperative Study of Evaluation in General Mathematics.

Leader: James H. Zant, Oklahoma A. & M. College, Stillwater, Oklahoma.

Group A5. Parlor K. Topic: How to Teach the Slide Rule

Leader: Carl N. Shuster, State Teachers College, Trenton, New Jersey

Group A6. Parlor L. Topic: Individualized Instruction in Junior High School Mathematics

Leader: Elizabeth Roudebush, Director of Mathematics, Seattle Public Schools, Seattle, Washington

Group A7. Parlor M. Topic: Mathematical Training of the Elementary School Teacher

Leader: K. G. Fuller, Dean, Teachers College of Connecticut, New Britain, Connecticut

12:15 P.M. Get-Acquainted Luncheon—Gold Room

Note: Make reservations in advance. See reservation blank at end of program.

(Guest speaker to be announced)

1:15 to 2:15 P.M. Mathematics Films—Parlors A and B

2:15 to 4:15 P.M. Elementary School Section—Walnut and English Rooms

Adventures in Studying Number
Ida Mae Heard, Southwestern Louisiana Institute, Lafayette, Louisiana

Certain Practical Features of Arithmetic Teaching
Don C. Rogers, Assistant Superintendent in Charge of Elementary Education, Board of Education, Chicago, Illinois

Can We Teach Pupils to Distinguish Between the Measurement and Partition Ideas in Division?
Harold E. Moser, State Teachers College, Towson, Maryland

2:15 to 4:15 P.M. Upper Grades—Junior High School Section—Casino Room

Presiding: Nanette Roche Blackiston, Supervisor of Junior High School Mathematics, Department of Education, Baltimore, Maryland

Save While You May—A Successful Banking Program
Beulah Parker, Benjamin Franklin Junior High School, Baltimore, Maryland

The Magic of Mathematics
Esther Schwartz, Garrison Junior High School, Baltimore, Maryland

A Visit to the 'Rec' Center—The Builder Takes a Class Behind the Scenes
Gertrude Holzapfel, Hamilton Junior High School, Baltimore, Maryland

2:15 to 4:15 P.M. Secondary School Section—Gold Room

Motivating the Study of Solid Geometry through the Use of Mineral Crystals
Josephine Phillips, Longwood College, Farmville, Virginia

The Implications of the Basic Studies of the Illinois Secondary School Curriculum for Mathematics Education
H. B. Henderson, College of Education, University of Illinois, Urbana, Illinois

Contrasts between Mathematics in Germany and in the United States
H. C. Christofferson, Acting Director, Student Teaching, Miami University, Oxford, Ohio

2:15 to 4:15 P.M. Instructional and Learning Aids Section—Parliament Room

Ideas for Enriching the Slide Rule Unit
Arvo Lohela, University High School, Ann Arbor, Michigan

Directing Student Production of Learning Aids
Emil J. Berger, Monroe High School, St. Paul, Minnesota

New Teaching Aids for Plane Geometry
Amelia Richardson, McKeesport High School, McKeesport, Pennsylvania

2:15 to 4:15 P.M. Junior College and College Section—Pine Room

A Testing Program for Freshmen to Determine Preparedness for College Mathematics
Herbert Hannon, Western Michigan College of Education, Kalamazoo, Michigan

What, if any, Permanent Values Have Courses in Mathematics for Students who Will Make no Professional Use of Them?
Norman Miller, Queen's University, Kingston, Ontario

Trends in College Mathematics
Wayne Dancer, University of Toledo, Toledo, Ohio

2:15 to 4:15 P.M. Teacher Training Section—Casino Foyer

The Role of the Supervisor in Charting the Course of the Student Teacher
Lurnice Begnaud, Lafayette High School and Southwestern Louisiana Institute, Lafayette, Louisiana

The Problem of Teacher Training in Arithmetic
Raymond M. Cook, Dean, Chicago Teachers College, Chicago, Illinois

Meaning and Understanding in Mathematical Instruction
Aaron Bakst, School of Education, New York University, New York, New York

2:15 to 4:15 P.M. Film Forum (Secondary School Films)—Parlors A and B

Forum Leader to be announced

2:15 to 4:15 P.M. Kappa Mu Epsilon—Parlor F

2:15 to 4:15 P.M. Discussion Groups and Clinics

(Reservations for attendance and participation should be made in advance)

Group B1. Parlor E. Topic: Aids in Teaching Junior High School Mathematics
Leader: Florence B. Miller, Shaker Heights, Ohio

Group B2. Parlor G. Topic: How to Make Multi-Sensory Aids Available?
Leader: M. H. Ahrendt, Anderson

College, Anderson, Indiana

Group B3. Parlor I. Topic: Teaching Reading Techniques Essential to Success in Mathematics

Leader: Catherine A. V. Lyons, Perry High School, Pittsburgh, Pennsylvania

Group B4. Parlor J. Topic: Let's Make Algebra Teaching Colorful

Leader: Frances C. Johnson, Senior High School, Oneonta, New York

Group B5. Parlor D. Demonstration of the Production and Use of Slides in Junior High School Classes

1. Every Teacher Can Be a Producer of Devices and Slides
   Agnes Herbert, Clifton Park Junior High School, Baltimore, Maryland
2. Slides Used in the Oakland Schools
   Elenore M. Lazansky, Claremont Junior High School, Oakland, California

Group B6. Parlor L. Topic: Making the Second Course in Algebra a Year of Opportunity for the Average Student

Leader: Elsie Parker Johnson, Oak Park and River Forest High School, Oak Park, Illinois

4:15 to 5:15 P.M. Mathematics Films—Parlors A and B

6:00 P.M. Annual Banquet—Gold Room

Mathematics—Its Role Today

Herold C. Hunt, General Superintendent of Schools, Board of Education, Chicago, Illinois

An Engineer Looks at Mathematics Teaching

Everett S. Lee, Executive Engineer, General Engineering and Consulting Laboratory, General Electric Company, Schenectady, New York

Note: Make reservations in advance. See announcements at end of program.

9:30 P.M. Night (H)Owl Session—Walnut, English and Pine Rooms

Informal hour(s) in which new problems are expounded, actions lead to reactions, and discussions of functions of more than one variable result in new maxim(um)s!

SATURDAY, APRIL 15, 1950

8:00 A.M. to 3:00 P.M. Registration—Francis I Room

8:00 A.M. Delegate Assembly Meeting—Pine Room

8:30 A.M. to 10:00 A.M. Mathematics Filmstrips—Parlors A and B

9:00 to 10:15 A.M. General Address followed by Discussion—English and Walnut Rooms

Effective Quantitative Thinking

John R. Clark, Teachers College, Columbia University, New York, New York

9:00 to 10:15 A.M. General Address followed by Discussion—Casino Room

The Teaching of General Mathematics, Grades 7 to 9

Virgil S. Mallory, State Teachers College, Montclair, New Jersey

9:00 to 10:15 A.M. Class Demonstration Lesson—Gold Room

Howard F. Fehr, Teachers College, Columbia University, New York, New York

10:30 A.M. to 12 M. Elementary School Section—Pine Room

Baltimore's Approach to the Meaningful Arithmetic Program

Elizabeth Hartje, Elementary Supervisor, Department of Education, Baltimore, Maryland

The Metric System—A Visual Aid in Teaching the Meaning of Place Value in Arithmetic

J. T. Johnson, Chicago Teachers College, Emeritus, Chicago, Illinois

10:30 A.M. to 12 M. Junior High School Section—English and Walnut Rooms

Meeting the Needs of the Individual—Self-Directed Homework

Rose Klein, Junior High School 252, Brooklyn, New York

Contributions to Awaken the Interest in Geometry (with Slides)

H. v. Baravalle, Adelphi College, Garden City, New York

10:30 A.M. to 12 M. Secondary School Section—Casino Room

The Place of the Variable in the Teaching of Mathematics

Barnett Rich, Richmond Hill High School, Richmond Hill, New York

Meeting the Larger Objectives of Geometry with Academic and Non-Academic Classes

Rolland R. Smith, Coordinator of Mathematics, Public Schools, Springfield, Massachusetts

10:30 A.M. to 12 M. Special Groups Section—Casino Foyer

Mathematics for Educable Mentally Handicapped Teen-Agers

Edyth M. Anderson, East Junior High School, Aurora, Illinois

Teaching Plane Geometry to Mentally,

Physically, and Emotionally Handicapped Pupils

Allene Archer, Thomas Jefferson High School, Richmond, Virginia

10:30 A.M. to 12 M. Instructional and Learning Aids Section—Parliament Room

Models—Induction—Demonstration—A Trilogy for Plane Geometry

Frances M. Burns, Oneida High School, Oneida, New York

The Construction and Use of Inexpensive Teaching Aids for Secondary School Mathematics

Russell L. Schneider, Eastern High School, Lansing, Michigan

10:30 A.M. to 12 M. Junior College and College Section

A Survey Course in Mathematics for College Freshmen

H. S. Kaltenborn, Memphis State College, Memphis, Tennessee

A Program for Implementing a More Comprehensive Mathematics Curriculum in Liberal Arts Colleges

Paul Meadows, Carroll College, Waukesha, Wisconsin

10:30 A.M. to 12 M. Teacher Training Section—Parlor F

A University Mathematics Department Goes to Work on Teacher Training

H. C. Trimble, Florida State University, Tallahassee, Florida

Professional Laboratory Experiences in the Training of Mathematics Teachers

Donovan A. Johnson, University High School, University of Minnesota, Minneapolis, Minnesota

10:30 A.M. to 12 M. Panel Discussion on Approximate Computation—Parlor D

Leader of Panel: Carl N. Shuster, State Teachers College, Trenton, New Jersey

Discussants: Aaron Bakst, New York University, New York, New York. William A. Gager, College of Arts and Sciences, University of Florida, Gainesville, Florida

10:30 A.M. to 12 M. Discussion Groups and Clinics

(Reservations for attendance and participation should be made in advance)

Group C1. Parlor E. Topic: Problems Connected with Rate of Progress of Pupils of Varying Abilities (Upper Grades)

Leader: C. C. Grover, Assistant Superintendent, Oakland Public Schools, Oakland, California

Group C2. Parlor G. Topic: Teaching Mathematics to Emphasize Solving Problems Initiated by Pupil Interest

Leader: Ava M. Seedorff, Senior High School, Battle Creek, Michigan

Group C3. Parlor I. Topic: Procedures We Have Tried in Teaching Plane and Solid Geometry, Tricks of the Trade

Leader: Kathryn W. Lynch, Saint Albans High School, Saint Albans, West Virginia

Group C4. Parlor J. Topic: What Mathematics Shall Be Included in the Second and Third Year Courses in General Mathematics?

Leader: Robert E. K. Rourke, Headmaster, Pickering College, Newmarket, Ontario

Group C5. Parlor K. Topic: Sociograms: A Technique for Formulating Work Groups in Mathematics Classes

Leader: Ida May Bernhard, Demonstration School, Southwest Texas State Teachers College, San Marcos, Texas

Group C6. Parlor L. Topic: What Provisions Should Be Made for Individual Differences in the Study of Junior High School Mathematics?

Leader: Herschel E. Grime, Directing Supervisor of Mathematics, Board of Education, Cleveland, Ohio

Group C7. Parlor M. Topic: Plastics for Clarity and Understanding

Leader: Luther Shetler, University School, Bloomington, Indiana

12:15 P.M. State and Provinces Luncheon—Gold Room

Meet old friends, make new ones, and sing with them too

Note: Make reservations in advance. Any group wishing to reserve a table communicate with Mrs. Florence B. Young, Steinmetz High School, 3030 No. Mobile Avenue, Chicago 34, Illinois. See announcement at end of program.

1:15 to 2:15 P.M. Mathematics Films—Parlors A and B

2:15 to 4:15 P.M. Film Forum (Elementary School Films)—Parlors A and B

Forum Leader: Donovan Johnson, University of Minnesota, Minneapolis, Minnesota

2:15 to 4:15 P.M. Elementary School (Evaluation) Section—Casino Foyer

Providing and Promoting Better Evaluation in Arithmetic

Ann C. Peters, Keene Teachers College, Keene, New Hampshire

An Evaluation of Problem Tests which

Include Formal Analysis
Robert L. Burch, School of Education, Boston University, Boston, Massachusetts

2:15 to 4:15 P.M. Junior High School Section—Casino Room
What Shall We Do in the Junior High School about the Slow Child and about Visual Aids? A Panel Discussion
Mary A. Potter, Supervisor of Mathematics, Racine, Wisconsin
Mary Barry, Washington Junior High School, Racine, Wisconsin
Lucy Smith, McKinley Junior High School, Racine, Wisconsin
Gerhardt Stelter, Franklin Junior High School, Racine, Wisconsin
Harriet Weltman, Mitchell Junior High School, Racine, Wisconsin

2:15 to 4:15 P.M. Secondary School Section—Gold Room
Some Uses of Graphical Methods in the Medical Sciences
Gaylord C. Montgomery, John Burroughs School, Clayton, Missouri
On Teaching Plane Geometry as Elementary Scientific Method
Nathan Lazar, Midwood High School, Brooklyn, New York

2:15 to 4:15 P.M. General Mathematics Section—Pine Room
Recreational Mathematics
Louise Kinn, Franklin Junior High School, Brainerd, Minnesota
Mathematics in the Life Adjustment Education Program
F. G. Lankford, Jr., University of Virginia, Charlottesville, Virginia
Mathematics for the Home Maker (A Unit for the Twelfth Grade)
Mary C. Rogers, Roosevelt Junior High School, Westfield, New Jersey.

2:15 to 4:15 P.M. Teacher Training Section—Parlor F
Mathematics in the General Education Program for Elementary and High School Teachers
Houston T. Karnes, Dean of Men, Louisiana State University, Baton Rouge, Louisiana
A Five Year Program of Preparation for Mathematics Teachers
Myron F. Rosskopf, Syracuse University, Syracuse, New York

2:15 to 4:15 P.M. Curriculum Section—English and Walnut Rooms
Functional Mathematics—Grades Seven through Twelve
William A. Gager, College of Arts and Sciences, University of Florida, Gainesville, Florida
Making Mathematics Meaningful—Pennsylvania's State Program. A. I. Oliver, School of Education, University of Pennsylvania, Philadelphia, Pennsylvania.

2:15 to 3:45 P.M. Discussion Groups and Clinics

(Reservations for attendance and participation should be made in advance)

Group D1. Parlor D. Topic: How and Why Should We Emphasize Basic Generalization in Teaching Arithmetic?
Leader: Irene Sauble, Director, Exact Sciences, Detroit Public Schools, Detroit, Michigan

Group D2. Parlor E. Topic: What Methods Can Be Used for Creating New Interest in Mathematics?
Leader: Walter H. Carnahan, Purdue University, Lafayette, Indiana

Group D3. Parlor G. Topic: The Construction and Use of Models in a Mathematics Laboratory
Leader: Col. Robert C. Yates, United States Military Academy, West Point, New York

Group D4. Parlor I. Topic: Teaching Locus
Leader: A. M. Welchons, Arsenal Technical Schools, Indianapolis, Indiana

Group D5. Parlor J. Topic: How Can We Best Provide for the Individual Differences Confronted by Teachers of Mathematics in the Elementary School?
Leader: W. I. Layton, Dean of Instruction, State Teachers College, Frostburg, Maryland

Group D6. Parlor K. Topic: What Shall We Do with Story Problems in Junior High School Mathematics?
Leader: Irvin H. Brune, Iowa State Teachers College, Cedar Falls, Iowa

Group D7. Parlor L. Topic: Are We Giving Every Pupil the Kind of Mathematics Most Necessary for Him?
Leader: Ona Kraft, Collinwood High School, Cleveland, Ohio

ANNOUNCEMENTS

Room Reservations: All applications for rooms should be sent directly to the Congress Hotel, Michigan Avenue and Congress Street, Chicago 5, Illinois. Room rates are as follows:

Singles: $4.00-$5.00-$6.00-$7.00
Twins: $7.50-$8.00-$9.00-$10.00

Three persons in a room @ \$9.00 per room

Four persons in a room @ \$10.00 per room

Sight-Seeing Trip and Visit to Museums: Buses will leave the Congress Hotel at 1:00 P.M., Thursday, April 13. Points of interest will include Chicago's old "Gold Coast," the University of Chicago and Lorado Taft's "Fountain of Time" on the Midway. There will be a one-hour stop-over at the Museum of Science and Industry. The tour will then turn north on the Outer Drive passing Soldier's Field, the Chicago Natural History Museum and the Shedd Aquarium. The tour will end at the Adler Planetarium with a lecture and demonstration. Price of this tour, including tax, is \$1.15. Those who do not wish to go on the tour but desire to attend the lecture at the Planetarium at 3:00 P.M. may take Bus No. 26 at Jackson and Michigan Avenues directly to the Planetarium. Fare, 13 cents each way. Persons on the tour not wishing to attend the demonstration at the Planetarium may take Bus No. 26 back to the hotel.

Luncheon and Banquet Reservations: Reservations for the Get-Acquainted Luncheon on Friday, April 14 and the States and Provinces Luncheon on Saturday, April 15 may be made in advance by sending checks with accompanying order sheet. The price for each luncheon is \$2.85 including tax and tip. The price for banquet tickets will be \$4.00 including tax and tip. Orders received by March 31 will be acknowledged by mail. All requests for luncheon and banquet reservations should be sent to National Council of Teachers of Mathematics, 212 Lunt Building, Northwestern University, Evanston, Illinois.

Refunds on Reservations: No ticket refunds will be made later than three hours preceding the functions for which reservations were made, e.g., the Sight-Seeing Trip, the Luncheons, and the Banquet.

Dinner Meeting: The Reeve Gang and Teachers College Alumni will meet for dinner at 5:30 P.M., Thursday, April 13. For reservations, write Dr. J. T. Johnson, 177 North Grove Ave., Oak Park, Ill.

Breakfast Meetings: Fawcett's Ohio Staters will meet for breakfast at 7:30 A.M. Friday, April 14. For reservations, write Mrs. Clarence E. Hardgrove, Department of Education, The Ohio State University, Columbus 10, Ohio.

The Duke Mathematics Institute Reunion Breakfast will be held at 7:30 A.M. Friday, April 14. For reservations write Miss Veryl Schult, Wilson Teachers College, Washington, D.C.

Discussion Groups and Clinics: Requests for attendance at these meetings should be made in advance. First, second, third and fourth choices should be sent to National Council of Teachers of Mathematics, 212 Lunt Building, Northwestern University, Evanston, Illinois. If attendance at more than one group is desired, this should be indicated. Admittance cards will be returned by mail to those making their requests before March 31, 1950. Admittance to these groups will be by admission card only.

Registration: There will be a registration fee of fifty cents for members of the National Council, members of the Mathematics Association of America and for teachers in elementary schools. The fee for non-members and visitors is \$1.50. Undergraduate students sponsored by a faculty member; relatives of members; invited speakers who are not members; members of the press, and exhibitors are admitted without payment of registration fee, but should register at the registration desk.

Exhibits: There will be an exhibit of mathematical models, instruments, and teaching aids in one of the convention rooms. Teachers are invited to bring materials for exhibit and should communicate in advance with Mr. Reino M. Takala, Hinsdale Township High School, Hinsdale, Illinois.

Many free and inexpensive teaching materials will also be on exhibit. Suggestions of recent materials which have become available and have classroom value should be sent to Miss Virginia Terhune, Proviso Township High School, Maywood, Illinois. A complete list of such materials and their sources as well as titles of books for high school and classroom libraries will be available free of charge for all in attendance at this annual meeting.

Commercial Exhibits: Textbooks and Commercial Teaching Aids will be on exhibit in the Florentine Room on the Third Floor. Inquiries for exhibit space should be addressed to Mr. E. L. Paine, Downers Grove Community High School, Downers Drove, Illinois.

Supplies and Equipment: Speakers and other participants in the program who need blackboards, projection equipment or other materials should communicate not

later than March 31 with Mr. Henry Swain, New Trier Township High School, Winnetka, Illinois.

Films and Filmstrips: Persons wishing to view specific films while in attendance at the meeting should communicate with Mr. Donald Smith, New Trier Township High School, Winnetka, Illinois, not later than March 15, 1950.

Location of Meeting Rooms in Congress Hotel:

Casino Room, First Floor, South End of Hotel
Casino Foyer, First Floor, South
Francis I Room, Second Floor, South
Gold Room, Second Floor, South
English Room, Second Floor, Center
Walnut Room, Second Floor, Center
Pine Room, Second Floor, Center
Florentine Room, Third Floor, North
Parliament Room, Third Floor, North
Parlors A, B, D, Third Floor, South of Parliament Room
Parlors E, F, G, I, K, L, and M, Third Floor, North

Mail and Telegrams: Mail and telegrams for those attending the meeting should be addressed in care of the National Council of Teachers of Mathematics, Congress Hotel, Michigan Boulevard at Congress Street, Chicago 5, Illinois. Mail may be obtained at the registration desk.

RESERVATION FORM AND ADVANCED REGISTRATION FORM

Please mail to National Council of Teachers of Mathematics, 212 Lunt Building, Northwestern University, Evanston, Illinois, before March 31, 1950.

Name ____
Last Name First Name Middle Initial

Home Address ____
Street and Number City Zone State

School Address ____
Name of School City State

Indicate with an X in front of address, the one to which tickets should be sent.

Member of N.C.T.M. Yes ( ) No ( ); M.A.A. Yes ( ) No ( ); Student ( )

Please check your fields of interest:

( ) Elem. ( ) Jr. H.S. ( ) High School ( ) Jr. Col. ( ) College
( ) Teacher Training ( ) Supervision ( ) Other (please state)

Registration Fee	$0.50 or $1.50	Amount Enclosed ________
Sight-Seeing Trip	$1.15	Amount Enclosed ________
Friday Luncheon	$2.85	Amount Enclosed ________
Friday Banquet	$4.00	Amount Enclosed ________
Saturday Luncheon	$2.85	Amount Enclosed ________

I enclose (check, money order) for $________ to pay for the above. (Checks or money orders should be made payable to J. J. Urbancek, Treasurer, Chicago meeting.)

Discussion Sections:

My choice for discussion sessions is as follows:
(Please insert name of leader and name of group as listed on program.)

1st choice: Group ________________ Leader ________________
2nd choice: Group ________________ Leader ________________
3rd choice: Group ________________ Leader ________________
4th choice: Group ________________ Leader ________________

(Indicate if attendance at more than one group is desired.)